QUBICAAMF
MAKING BOWLING AMAZING

EDGE
FREE FALL

Service and Parts Manual

Original Instructions Written in English

www.qubicaamf.com

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DOCUMENT UPDATES

This manual supersedes all previous versions of the EDGE Free Fall Owner's Manual. QubicaAMF Worldwide, LLC reserves the right to revise and/or update this manual at any time without obligation to notify any person or entity of such revision. The document number, revision level, and date below indicate the edition of this manual.

TRADEMARK NOTICES

CONDITIONAL INFORMATION

This manual assumes that the QubicaAMF equipment and/or software has been installed by a QubicaAMF-authorized technician and is functional in every aspect. Should you encounter problems in operating the equipment, follow the instructions in this manual before contacting QubicaAMF Worldwide for service under warranty.

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EDGE Free Fall Service & Parts Manual

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Table of Contents

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Table of Contents

Section 1 INTRODUCTION 1-1
1.1. How to Use This Manual 1-5
1.2. Manual Layout 1-5
1.3. QubicaAMF Worldwide, LLC 1-7
1.4. QubicaAMF's Commitment to Quality 1-8
Section 2 SAFETY 2-1
2.1. General Safety Guidelines and Symbols 2-5
2.2. Safety Procedures and Precautions 2-8
2.2.1. EDGE Free Fall Lockout/Tagout (LOTO) Procedure 2-8
2.3. Crow's Nest 2-18
2.3.1. Clear Pin Jam from Crow's Nest 2-18
2.3.2. Setup Pins from Crow's Nest 2-18
2.4. Safety Guards and Labels 2-19
Section 3 BASIC PINSPOTTER OPERATION 3-1
3.1. Pinspotter Mechanical Operation 3-5
3.1.1. Four Basic Pinspotter Functions 3-5
3.1.2. Nine Basic Pinspotter Components 3-5
3.1.3. Five Basic Pinspotter Cycles 3-8
3.2. Pinspotter Electrical Operation 3-11
3.2.1. Motors 3-11
3.2.2. Encoders & Switches 3-12
3.2.3. Protection Devices 3-12
3.2.4. Machine Pit Time Delay 3-13
3.2.5. Frame Counters 3-13
3.2.6. Bowler's Pit Signal System 3-13
3.2.7. Tenth Frame Button 3-13
3.2.8. Ball Detector 3-14
3.2.10. CenterPunch Deck Light Operation 3-19
3.3. Electrical Drawings and Pinspotter Ratings 3-20
3.4. Other Supplemental Manuals 3-20
Section 4 A SERVICE 4-1
4.1. Service Tools 4-5
4.1.1. Service Tool Kits 4-5
4.1.2. Service Tools 4-6
4.2. Machine Adjustments 4-11
4.2.1. Machine Height and Position Adjustments 4-11
4.2.2. Table Adjustments 4-13
4.2.3. Sweep Operation and Adjustments 4-37
4.2.4. Positive Ball Lift 4-42
4.2.5. Distributor 4-43
4.2.6. Durabin and Shuttle Operation & Adjustment 4-44
4.2.7. Cushion Operation and Adjustments 4-48
4.2.8. Pin Conveyor Belt & Adjustments 4-53
4.3. Critical Measurements 4-57
Section 4 B MAINTENANCE 4-61

WORLDWIDE HEADQUARTERS
8100 AMF Drive - Mechanicsville, Va 23111 - USA
Tel: (804) 569-1000

EUROPEAN HEADQUARTERS
Via della Croce Coperta, 15 - 40128 Bologna - Italy
Tel: +39 051.4192.611

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4.4. Lubrication 4-65
4.4.1. Lubrication Instructions & Symbols 4-65
4.4.2. Table Drive Assembly 4-67
4.4.3. Sweep Drive and Linkages 4-71
4.4.4. Respot Cells 4-73
4.4.6. Yoke Assembly 4-74
4.4.7. Table Shifter Mechanism 4-75
4.4.8. Table Actuator and Connector Assemblies 4-76
4.4.10. Durabin & Shuttle Assembly 4-77
4.4.11. Shock Absorber 4-78
4.4.12. Backend Side Plate Assembly 4-79
4.5. Scheduling Preventive Maintenance 4-80
4.5.1. QubicaAMF Weekly Preventive Maintenance Chart 4-80
4.5.2. Preventive Maintenance Schedule 4-81
4.6. Maintenance Procedures 4-87
4.6.1. 25,000 Frame Maintenance 4-87
4.6.2. 50,000 Frame Maintenance 4-92
4.6.3. 100,000 Frame Maintenance 4-96
4.6.4. 200,000 Frame Maintenance 4-106
4.6.5. 500,000 Frame Maintenance 4-109
Section 4 C TROUBLESHOOTING 4-115
4.7 Troubleshooting 4-119
4.7.1. Troubleshooting Tools 4-119
4.7.2. Table Troubleshooting 4-120
4.7.3. Sweep Troubleshooting 4-128
4.7.4. Cushion and Pit Troubleshooting 4-137
4.7.5. System Controller Troubleshooting 4-142
4.7.6. Motor Troubleshooting 4-146
4.7.7. Centerpunch Deck Lighting Troubleshooting (when not connected to Effects Server) 4-148
Section 5 DRAWINGS & PART NUMBERS 5-1
Front End Frame & Platform Assembly – Odd Machine 5-4
Front End Frame & Platform Assembly – Even Machine 5-6
Front End Frame Assembly – Even & Odd Machines 5-8
Front End Electrical Installation 5-10
Ball Detector Assembly 5-12
Front End Drive 5-14
Solenoid & Shuttle Operating Assembly 5-16
Table Drive Assembly 5-18
Spot & Respot Linkages 5-20
Sweep Arm Assembly 5-22
Sweep Bar & Mounting Assembly 5-24
Table & Crossbeam Assembly 5-26
Table & Bracket Assembly 5-29
Tie Rod Bracket Assembly 5-30
Front Actuator & Connector Assemblies 5-32
Table & Respot Links 5-34
Table & Respot Cells 5-36

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8100 AMF Drive - Mechanicsville, Va 23111 - USA
Tel: (804) 569-1000

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Via della Croce Coperta, 15 - 40128 Bologna - Italy
Tel: +39 051.4192.611

web: www.qubicaamf.com - email: info@qubicaamf.com - eshop: eshop.qubicaamf.com

Respot Cell Assembly Cells 7 through 10 5-38
Respot Cell Assembly, Cells 1 through 6 5-40
X Frame to Table Connections 5-42
Yoke & Spotting Cup Assembly 5-44
Durabin II Assembly 5-46
Durabin II Shuttle Actuator 5-48
Shuttle Assembly 5-50
Backend Assembly 5-53
Kickback Plate Assembly - Ball Exit Side 5-54
Kickback Plate Assembly – Opposite Ball Exit Side 5-56
Bounce Plate & Roller Assembly 5-58
Cushion, Curtain & Shock Absorber Assembly 5-61
Backend Gear, Motor & Bracket Assembly 5-62
System Controller & Mounting Bracket Assembly 5-64
Guards & Safety Labels 5-66
PARTS INDEX 5-71

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Section 1 INTRODUCTION

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Contents

Section 1 INTRODUCTION 1-1
1.1. How to Use This Manual 1-5
1.2. Manual Layout 1-5
1.3. QubicaAMF Worldwide, LLC 1-7
1.4. QubicaAMF's Commitment to Quality 1-8

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1.1. How to Use This Manual

This manual set is provided for use by trained and authorized bowling center mechanics in conjunction with the adjustment and maintenance of QubicaAMF EDGE Free Fall pinspotters, including the EDGE Performance Lift, the EDGE Free Fall Distributor, the Positive Ball Lift (PBL) and Light Ball Sensor (LBS), the EDGE Free Fall System Controller, and associated equipment. This pinspotter manual does not cover the installation of the pinspotter or associated equipment.

Several manuals are included in this manual set. These manuals may provide instructions for the installation of the associated equipment related to repair or replacement. Refer to the Appendices at the back of the manual for information specific to this equipment.

Refer to Section 2, *Safety*, before proceeding with machine maintenance.

1.2. Manual Layout

The QubicaAMF EDGE Free Fall Pinspotter Service and Parts Manual is divided into individual sections by the section tabs. Each section contains its own Table of Contents to help the user find a topic within that section. Several sections include subsection tabs for quick reference. The complete Table of Contents for all sections is provided at the beginning of this manual, a Parts Section Table of Contents is located at the beginning of Section 5.0, and a replacement part number index can be found at the end of Section 5.0.

Section Tab	Subsection Tab	
Section 1 - Introduction	1.1	How to Use This Manual
	1.2	Manual Layout
	1.3	QubicaAMF Worldwide, LLC
	1.4	QubicaAMF Bowling's Commitment to Quality
Section 2 - Safety	2.1	General Safety Guidelines
	2.2	Safety Procedures & Precautions
	2.3	Safety Guards & Labels
Section 3 - Operation	3.1	Pinspotter Mechanical Operation
	3.2	Pinspotter Electrical Operation
Section 4 - Service & Maintenance	4.1	Service Tools
	4.2	Machine Adjustments
	4.3	Critical Measurements
	4.4	Lubrication
	4.5	Scheduling Preventive Maintenance
	4.6	Maintenance Procedures
	4.7	Troubleshooting
Section 5 - Parts	5.0	Part Numbers & Drawings, Parts Index

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Appendix A - EDGE Free Fall System Wiring Diagram

Appendix B - EDGE Free Fall Distributor Manual

Appendix C - Positive Ball Lift (PBL) Manual

Appendix D - EDGE Free Fall System Controller Manual

Appendix E - EDGE Free Fall Motor & Gearbox Manual

Appendix F - EDGE Performance Lift Manual

Appendix G - EDGE Free Fall Manager's Control Unit (MCU) Manual

Appendix H – Radaray XL*i* Foul Detector Manual

Appendix I – Enhanced Guarding Manual

Appendix J - QV-3000 Camera Manual

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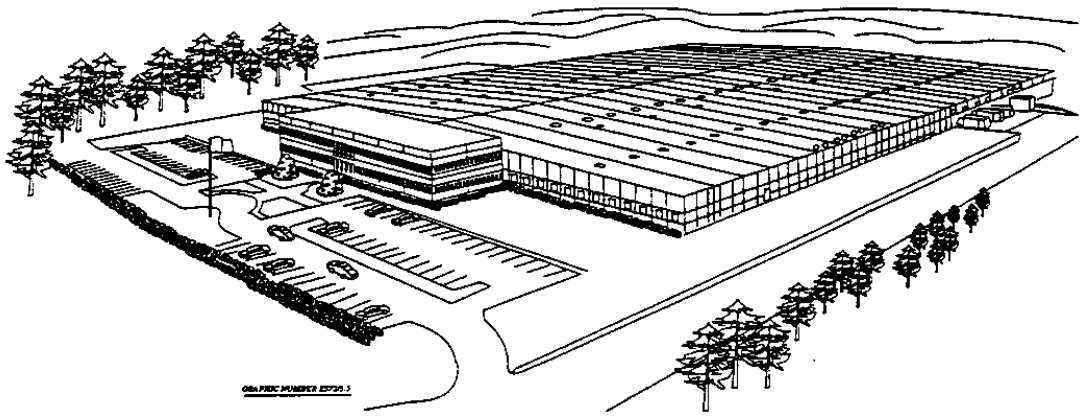
1.3. QubicaAMF Worldwide, LLC

- QubicaAMF Worldwide, LLC (formerly AMF) was founded in New York in 1900 as the American Machine and Foundry Co., Inc. AMF's first product was automated machinery for the tobacco industry.
- In 1936, the pinspotter was invented by Fred Schmidt in his garage in Pear River, New York. AMF hired him in 1938 allowing him to perfect his invention. The war delayed production, but in 1946 the pinspotter made its first public debut at the World's Fair. In 1951, the pinspotter went into production and revolutionized tenpin bowling.
- In 1946, AMF introduces "pindilator", the first automatic pinspotting machine, at the ABC Tournament in Buffalo, New York, and the first automated pinspotter to be installed and used by bowlers in an ABC Championship in Fort Worth, Texas.
- In 1986, AMF Bowling was acquired from AMF Incorporated by a group of Richmond, Virginia, investors.
- IN 1988, AMF relocated their Corporate Headquarters, engineering offices, R&D lab, and manufacturing facilities to their current location, a new 375,000 square foot, 70 acre facility in Mechanicsville, Virginia.
- In 2004, AMF Bowling Worldwide, Inc. was acquired by the investment group of Code, Hennessy, & Simmons, LLC.
- In 2005, AMF Bowling Products and Qubica, an Italian manufacturer of a variety of bowling products, merged to form QubicaAMF Bowling Products, Inc.



QubicaAMF Bowling, Inc Corporate Headquarters Richmond, Virginia

- In 2014, Qubica legacy partners finalized a transaction with Bowlmor AMF to acquire complete ownership and creation of QubicaAMF Worldwide, LLC.

  The company has manufacturing facilities in Lowville, New York, which manufactures bowling pins and lanes.

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QubicaAMF is also a world leader in the manufacture and sale of bowling products, with a global market presence in more than 50 countries.

1.4. QubicaAMF's Commitment to Quality

When you make a commitment to QubicaAMF, QubicaAMF makes a commitment to you. A commitment to see that you get the very best. The best equipment, the best engineering, the best technology, and the best customer service and technical support in the industry. By having all of these disciplines under one roof, QubicaAMF is uniquely positioned to provide the finest in products and services to the bowling industry.

QubicaAMF's commitment to their customers doesn't stop after the sale. QubicaAMF strives to provide their customers with pinspotters that, with proper maintenance, will provide you with years of trouble-free operation. In the event that help is needed, QubicaAMF is ready to serve you.

For customer service or technical support from within the United States call

1-866-460-7263 option 3.

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Section 2 SAFETY

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Table of Contents

Section 2 SAFETY 2-1
2.1. General Safety Guidelines and Symbols 2-5
2.2. Safety Procedures and Precautions 2-8
2.2.1. EDGE Free Fall Lockout/Tagout (LOTO) Procedure 2-8
2.3. Crow's Nest 2-18
2.3.1. Clear Pin Jam from Crow's Nest 2-18
2.3.2. Setup Pins from Crow's Nest 2-18
2.4. Safety Guards and Labels 2-19

WORLDWIDE HEADQUARTERS
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2.1. General Safety Guidelines and Symbols

QubicaAMF feels strongly about its commitment to safety. Proper service and repair are important to the safety of the mechanic as well as the safe, reliable operation of the pinspotters. Please read, understand, and follow all of the recommended safety procedures presented in this manual.

The service procedures recommended and described in this technical manual are effective methods of performing service and repair. Some of these procedures require the use of tools specially designed for this purpose.

- **Properly trained personnel should be present whenever maintenance is being performed on a pinspotter.**
- **No unauthorized personnel should be allowed in the pinspotter/machine area.**
- **Keep in mind that the QubicaAMF EDGE Free Fall pinspotter performs a series of mechanical motions and electrical actions during each cycle, and that SEVERE BODILY INJURY OR DEATH could result should personnel enter the machine when power is on. When working in a pinspotter, it is recommended that power also be turned off on adjacent machines.**
- **Remember that safety must remain your first priority at all times.**
- **The sound pressure level (LpA) in the area of the system controller (operator's station) during bowling activities is in excess of 80 dBA. Hearing protection is recommended.**
- **Safety goggles, ear protection, and steel-toed shoes are recommended whenever any work is being performed on a pinspotter.**
- **Wearing loose clothing or jewelry is NOT RECOMMENDED when operating or maintaining the machinery.**
- **It is acceptable to clear pin jams with a pin hook with the machine running from the crow's nest (See Section 2.3 Crow's Nest page 2-18).**

It is important to note that this manual contains various symbols and wording that provide information that must be carefully followed in order to reduce the risk of personal injury during service or repair, or that warn of the possibility that improper service or repair may damage the pinspotter or render it unsafe.

Additionally, the QubicaAMF EDGE Free Fall pinspotter has a number of built-in features and components as well as various warning labels that are designed to minimize and warn against the risks associated with this equipment. Heed all warnings and do not defeat the safety features that come with your pinspotters. Never place the machine into service with any of the guards removed.

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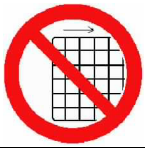
Some of the warning labels you may observe on the pinspotter or within this manual are shown on the following pages.

	This symbol means STOP, DO NOT PROCEED, and is a warning that hazards could exist. It is often followed by other symbols.
	This symbol indicates a LOCKOUT/TAGOUT point for performing maintenance.
	This symbol warns the mechanic to unplug the motor before servicing.
	This symbol indicates that eye protection is required.
	This symbol is a warning against breaking a photo eye beam, which will cause the machine to cycle.
	This symbol states that a crushing hazard exists.
	This symbol denotes that an entanglement hazard associated with gears exists.
	This symbol warns that a falling hazard exists.
	This symbol states that use of a pin hook is required.
	This symbol denotes that the use of lane barriers is required.

	This symbol means that the mechanic should read, understand, and follow the technical manual before servicing the machine.
	This symbol reminds the user to remove main power from the machine prior to performing maintenance.
	This symbol indicates STOP! NO ACCESS FOR UNAUTHORIZED PERSONS. Service should be performed by authorized, trained personnel only.
	This symbol indicates that hearing protection is required.
	This symbol indicates that the machine may start or cycle automatically without warning.
	This symbol is a warning against operating the equipment with the guards removed.
	This symbol denotes that an entanglement hazard associated with belts and pulleys exists.
	This symbol warns that a tripping hazard exists.
	This symbol warns that use of a dust mask is required.
	Warning! Hazard exists; use caution. Failure to follow all safety guidelines in this manual may result in personal injury.

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The symbols on the previous page may be displayed as follows:

It is also important to understand that the use of these symbols and labels is <u>not</u> all-inclusive because it is impossible to warn of all the possible hazards and consequences that could result from failure to follow these instructions. Trained and competent bowling center mechanics are able to recognize and avoid potentially hazardous situations.

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2.2. Safety Procedures and Precautions

The following section is a duplicate of document 400-088-113-xx EDGE Free Fall LOTO.

2.2.1. EDGE Free Fall Lockout/Tagout (LOTO) Procedure

Overview

This outlines the recommended Lockout/Tagout (LOTO) supplies and procedures for the EDGE Free Fall pinspotter. This information should be used to supplement a facility's existing LOTO program. Please note that the facility is responsible for creating and maintaining a LOTO program in compliance with applicable safety standards. This document alone does not constitute a regulation-compliant LOTO program.

Owner/Facility Manager Responsibilities

Under national law in the USA and EU countries, it is the responsibility of the owner/facility manager to provide a safe workplace. A safe working environment includes training on the proper use of LOTO procedures and devices.

WARNING:

- **High voltage is present inside the system controller. Use caution when operating or handling this equipment. Implement LOTO before servicing any electrical components. The main circuit breaker must always be OPEN, or the power plug DISCONNECTED, prior to performing any service/repair to electrical systems.**

- **The system controller contains no user-serviceable parts.**
- **The system controller includes a tamper indicator. Opening the system controller enclosure will void the warranty.**

I. LOTO Overview

Potential for serious injury exists if an operator attempts to work inside the machine boundary of an energized machine. A machine is considered energized whenever it is connected to a main power supply. Energized machines may cycle automatically. Machine components could move without warning and injure an operator attempting to work inside the machine boundary. No person should ever attempt to work inside the machine boundary of an energized machine!

LOTO includes a set of supplies and procedures for temporarily de-energizing a machine. With LOTO implemented, a machine's main electrical power is physically removed and can only be restored by the same operator who de-energized the equipment. This also prevents anyone from restoring electrical power inadvertently. LOTO is a crucial aspect of workplace safety when performing troubleshooting and maintenance tasks.

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Note

- A machine is energized if main electrical power is physically connected to a machine AND the machine's main power supply circuit breaker is ON.
- A machine may be energized even if its system controller power switch is set to OFF.
- A machine may be energized even if it is not operating.

II. LOTO Supplies

A. LOTO Device Overview

There is a wide variety of LOTO supplies depending on the application. Several common LOTO items are shown below. Note that some, but not all of these items are supplied with the EDGE Free Fall pinspotter. The owner/facility manager is responsible for selecting and procuring additional LOTO supplies based on the specific operational requirements of a given facility.

Padlocks

Plug Lockout

Lock Tags

Plug Lockout

Circuit Breaker Lockout

Lockout Hasp for Multiple Padlocks

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All manufacturer-supplied decals must be applied to LOTO supplies before use. All decals must be in place at all times.

Lockout Hasp for Multiple Padlocks

B. Distribution of LOTO Padlocks and Lock Tags

The owner/facility manager is responsible for the availability and safe distribution of all LOTO padlocks and lock tags. Below are two suggested procedures for managing this responsibility. Note, these are recommended procedures only. The owner/facility manager is responsible for defining all LOTO procedures based on the specific operational requirements of a given facility.

I. Padlock/Lock Tag Procedure 1

The owner/facility manager issues padlocks and lock tags directly to each operator permitted to work on the machine(s). Each operator should be issued a minimum of three lock tags. Each operator must mark his/her name on each lock tag using a permanent marker or label maker. Each operator must always keep all assigned padlocks and lock tags in his/her possession while on duty.

Operator padlocks and lock tags may be used together with a plug lockout, circuit breaker lockout, or lockout hasp to implement LOTO on a machine. These supplies should be kept in one secure area accessible to all operators. While LOTO is implemented, the operator must place his/her personal lock tag on the LOTO device. The operator must keep his/her key in his/her possession until all work is completed and LOTO is removed.

Once LOTO is removed, the operator should retrieve his/her personal lock tag and return all used LOTO supplies to the facility's designated safety center. An operator's personally assigned padlocks and lock tags should be stored in the facility's safety center while that operator is off duty.

II. Padlock/Lock Tag Procedure 2

The owner/facility manager issues a minimum of three lock tags directly to each operator permitted to work on the machine(s). Each operator must mark his/her name on each lock tag using a permanent marker or label maker. Each operator must always keep all assigned lock tags in his/her possession while on duty.

The owner/facility manager shall determine all required LOTO supplies (padlocks, plug lockouts, circuit breaker lockouts, lockout hasps, etc.) and shall locate these supplies at each machine.

While LOTO is implemented, the operator must place his/her personal lock tag on the LOTO device. The operator must keep the padlock key in his/her possession until all work is completed and LOTO is removed.

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Once LOTO is removed, the operator should retrieve his/her personal lock tag and return all used LOTO supplies to the designated safety center for that machine. An operator's personally assigned lock tags should be stored in the facility's safety center while that operator is off duty.

III. EDGE Free Fall LOTO Procedure

Below are recommended LOTO procedures for various machine/facility configurations. Note, these are recommended procedures only. The owner/facility manager is responsible for defining all LOTO procedures based on the specific operational requirements of the facility.

Read This First

- All operators must be trained on a facility's safety rules and practices (including LOTO) before performing any operation or maintenance tasks.
- Operators may perform required operation and maintenance tasks only under the supervision of a facility manager. Only a facility manager is authorized to conduct operator training.
- The operator who implements LOTO (as evidenced by lock tag) is the only person permitted to remove the LOTO. Under no circumstances is an operator allowed to unlock a LOTO device that was implemented by another operator. This includes, but is not limited to, cutting off padlocks or otherwise bypassing an LOTO device to restore machine power. Only a facility manager may grant authority to cut off a padlock after ensuring the machine is safe to energize.
- LOTO must be implemented before any machine guards are removed.
- All machine guards must be installed before a machine is energized.
- Never reach into or cross over the machine boundary of an energized machine.
- An energized machine may be observed from another machine to which LOTO has been applied.
- If a machine will be down overnight, turn off main power to the machine pair and leave a note for the next shift. LOTO is not required overnight if an operator is not inside the machine boundary. LOTO must be implemented when maintenance resumes.

A. LOTO at System Controller

The system controller main power plugs are the primary location for LOTO of a machine pair. Follow the steps below.

1. Turn off main power to the machine pair by switching the system controller main power switch to OFF.
2. Remove the system controller main power and logic power plugs.
3. Implement LOTO by placing the main power plugs in plug lockouts (place the logic cord in one of them). Lock the plug lockouts using padlocks and secure a lock tag

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through the padlock shackle. See Figure A-1. Note, the lock tag must be labeled with the name of the operator implementing the LOTO.

Figure A-1, EDGE Free Fall LOTO

If more than one operator will be working on the machine(s), each operator must place a padlock and lock tag on the plug lockout. Additional padlocks can be locked directly through the plug lockout (if the lockout has multiple lock holes) or can be used in combination with a multi-hole lockout hasp.

4. **TEST.** Verify that the machine pair is de-energized by switching the system controller main power switch to ON. Wait 10 seconds. If the system controller display remains off (blank) and there are no signs of machine activation (e.g. beeping, clicking, LEDs on, etc.), the machine pair is de-energized. Otherwise, LOTO has not been implemented correctly. Repeat Steps 1-4 to ensure LOTO is implemented correctly. After a successful test, switch the system controller main power switch back to OFF.
5. Perform all required maintenance, troubleshooting, cleaning tasks.
6. Once all work is complete, ensure that all personnel and tools are out of the machine boundary.
7. Remove all LOTO devices and re-insert the main power plugs and logic plug into the system controller.
8. Switch system controller main power switch to ON.

B. LOTO at Circuit Breaker Service Panel

LOTO may also be implemented at a facility's circuit breaker service panel. This method should be used for hard-wired equipment or devices that cannot be otherwise unplugged or turned off with a lockable switch. Note, all circuit breakers must be properly marked with the machine/device that they power (see Figure A-3). Follow the steps below.

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1. Turn off main power to the machine pair by switching the system controller main power switch to OFF.
2. Turn off the service panel circuit breakers that powers the machine pair.
3. Place a circuit breaker lockout over the appropriate circuit breakers. Lock the circuit breaker lockout using a padlock and secure a lock tag through the padlock shackle. See Figure A-4. Alternatively, a padlock may be used to lock the service panel door. Lock the door using a padlock and secure a lock tag through the padlock shackle. See Figure A-5. In either case, the lock tag must be labeled with the name of the operator implementing the LOTO.

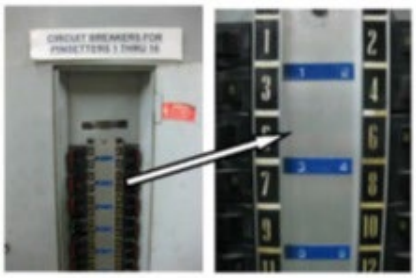

Figure A-3, Circuit Breaker Labels

Figure A-4, Circuit Breaker LOTO

Figure A-5, Service Panel LOTO

4. If more than one operator will be working on the machine(s), each operator must place a padlock and lock tag on the lockout device. Additional padlocks can be locked directly through the circuit breaker lockout (if the lockout has multiple lock holes) or can be used in combination with a multi-hole lockout hasp.
5. **TEST.** Verify that the machine pair is de-energized by switching the system controller main power switch to ON. Wait 10 seconds. If the system controller display remains off (blank) and there are no signs of machine activation (e.g. beeping, clicking, LEDs on, etc.), the machine pair is de-energized. Otherwise, LOTO has not been implemented correctly. Repeat Steps 1-4 to ensure LOTO is implemented correctly. After a successful test, switch the system controller main power switch back to OFF.
6. Perform all required maintenance, troubleshooting, cleaning tasks.
7. Once all work is complete, ensure that all personnel and tools are out of the machine boundary.

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8. Remove all LOTO devices and switch the service panel circuit breakers to ON.
9. Switch system controller main power switch to ON.

C. LOTO of Groups of Machines

It may sometimes be necessary to de-energize a large group of machines or all machines in a facility. Follow the steps below.

1. Turn off main power to each machine pair by switching the system controller main power switch to OFF.
2. Turn off all service panel circuit breakers that power the machines to be de-energized.
3. Close the service panel door. Lock the door using a padlock and secure a lock tag through the padlock shackle. See Figure A-5. The lock tag must be labeled with the name of the operator implementing the LOTO.
4. If more than one operator will be working on the machine, each operator must place a padlock and lock tag on the service panel door. Additional padlocks can be locked directly through the door (if the door has multiple lock holes) or can be used in combination with a multi-hole lockout hasp.
5. **TEST.** Verify that each machine pair is de-energized by switching the system controller main power switch to ON. Wait 10 seconds. If the system controller display remains off (blank) and there are no signs of machine activation (e.g. beeping, clicking, LEDs on, etc.), the machine pair is de-energized. Otherwise, LOTO has not been implemented correctly. Repeat Steps 1-4 to ensure LOTO is implemented correctly. After a successful test, switch each system controller main power switch back to OFF.
6. Perform all required maintenance, troubleshooting, cleaning tasks.
7. Once all work is complete, ensure that all personnel and tools are out of the machine boundary.
8. Remove all LOTO devices and switch the service panel circuit breakers to ON.
9. Switch each system controller main power switch to ON.

D. LOTO of Auxiliary Equipment

LOTO must be implemented on any device before performing maintenance tasks. Note that implementing LOTO on a machine pair does not de-energize all related auxiliary equipment, including the front ball return.

Depending on the design of the equipment to be LOTO, follow one of the above procedures to de-energize the device. Devices equipped with a main power plug can be LOTO using a plug lockout. Hard-wired devices must be LOTO at the circuit breaker powering the equipment. Always test to ensure that a device is fully de-energized before performing any maintenance tasks. After all work is complete, remove all LOTO devices, re-energize the equipment, and test for proper operation.

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IV. LOTO Inspection Procedure

The facility manager must conduct periodic inspections of the facility's machine guards, LOTO procedures, and LOTO supplies. This inspection must cover the requirements and procedures of this document [and 29 CFR 1910.147(c) in USA]. The purpose of this inspection is to ensure that all operators understand and follow such requirements and procedures and that all machine guards and LOTO supplies are present and in working order.

During the inspection, the facility manager must confirm that every authorized operator understands and can demonstrate how to conduct all applicable LOTO procedures. This aspect of the inspection must be documented in the LOTO Procedure Inspection Form (see next page).

The facility manager must note any deviations or inadequacies and develop a plan to correct those deviations or inadequacies through training, improved supervision, device replacement, or otherwise.

The facility manager must certify that he/she performed the inspection using the LOTO Procedure Inspection Form. The facility manager must sign and date this form, note the center name, address, and phone number, equipment type(s), all defects or deficiencies and the plan to correct them, and the names of all operators who participated in the inspection.

Inspection frequency is set by the facility manager and depends on the center's safety and operator training programs.

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LOTO Procedure Inspection Form	
Inspector's Full Name:	
Center Name:	**Center Address:**
Center Phone Number:	
Bowling Equipment Type(s):	
Correction Plan for any Deviations or Inadequacies Identified During Inspection:	

Operator Name(s):	Demonstrates understanding of all LOTO procedures, including proper use of all LOTO devices. (Yes/No)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

I hereby certify that I have conducted the LOTO Procedure Inspection to ensure that all LOTO procedures and the requirements of this section [and 29 CFR 1910.147(c) in USA] are being followed.

Inspector's Signature: _____

Date of Inspection: _____

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1. **PLACE THE SWEEP IN THE 1ST GUARD POSITION AND DISCONNECT THE POWER PLUG** before working on any pinspotter equipment and before entering any portion of a pinspotter. **FOR ENTRY INTO A PINSPOTTER, THE ADJACENT (PAIRED) PINSPOTTER MUST BE ISOLATED IN THE SAME MANNER AS THE PINSPOTTER BEING ACCESSED**. Follow your center's established lock-out and tag-out procedures.

   A lock-out device should be placed over the power connector to prevent power from being applied to the machine during maintenance or repair. Refer to Figure 2-1 for machine power connector locations.

   For pinspotter installations equipped with the EDGE Free Fall with SmartGuard™ Safety System, refer to the *XLi EDGE SmartGuard™ Safety System Manual*, 400-088-092, for specific information relating to electrical isolation requirements when entering the machine.

2. Be sure all safety guards are securely in place before operating a pinspotter.

3. Wait a minimum of 60 seconds after disconnecting the power plug before contacting any electrically charged pinspotter components.

4. NEVER alter pinspotter safety mechanisms or wiring.

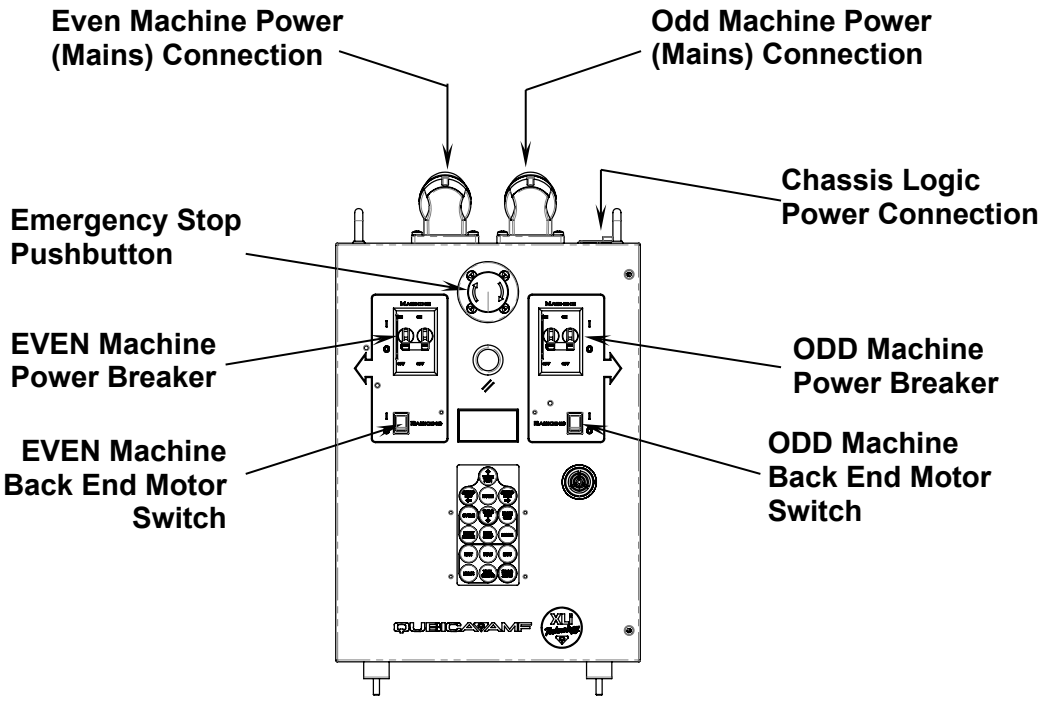

Figure 2-1

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2.3. Crow's Nest

The crow's nest is an area in between lane pairs and on end pinspotters where mechanics can safely enter the pinspotter to clear pin jams and setup pins (with a pin hook) and observe machine performance while the machine is running. What follows are the procedures for clearing pin jams and setting up pins from the crow's nest.

2.3.1. Clear Pin Jam from Crow's Nest

1. At system controller, press EVEN/ODD button so arrow is pointing toward lane with 2nd Guard error.
2. Press MODE Button to put pinspotter into mechanic mode.
3. Place breaker on system controller for that lane into the off position.
4. Climb into the crow's nest with a pin hook.
5. Use the pin hook to remove pins jammed from bin and distributor belt.
6. Climb out of crow's nest.
7. At system controller, place breaker in on position.
8. Press TROUBLE CLEAR button.
9. Climb into the crow's nest with a pin hook.
10. Using the pin hook, press trip lever to advance distributor to correctly fill bin and put into proper timing.
11. Climb out of crow's nest.
12. Ensure full pin setup on pin deck. If not, press BALL STEP button to place pinspotter in 2nd ball. Press CYCLE button.
13. Press MODE Button to put pinspotter into bowl mode.

2.3.2. Setup Pins from Crow's Nest

1. At system controller, press EVEN/ODD button so arrow is pointing toward lane requiring a pin setup.
2. Press MODE button to place pinspotter in mechanic mode.
3. Check pin deck to see if full set or partial set. If partial, note what pins are standing.
4. Turn off back end switch.
5. If on 1st ball, press CYCLE button.
6. After cycle completes, press BALL STEP button.
7. Press CYCLE button. Bin should be empty and sweep at 2nd guard.
8. Turn on back end switch allow pins to feed onto distributor.
9. Turn off back end switch.
10. From crow's nest using a pin hook, place pins into the appropriate bin pockets as needed. If a 9 pin is part of setup, it should be placed in bin last.
11. If more pins are needed to complete setup, turn on back end switch to allow more pins to feed onto distributor.
12. Turn off back end switch.
13. From crow's nest using a pin hook, place pins into the appropriate bin pockets as needed. If a 9 pin is part of setup, it should be placed in bin last.
14. If 9 pin was needed the pinspotter cycle will continue when it is placed in bin. If no 9 pin was needed, use the pin hook to trip the optical sensor in the 9 bin pocket for cycle to continue.
15. Press BALL STEP button to place machine in 2nd ball.
16. Press MODE button to place pinspotter in bowl mode.

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2.4. Safety Guards and Labels

For pinspotters equipped with the SmartGuard™ Safety System, refer to the EDGE Free Fall SmartGuard Safety System Manual, 400-088-092-xx, for additional information concerning the function and operation of the safety system as well as for additional safety requirements and Lockout/Tagout instructions.

All safety guards must be in place before operating the machine. When maintenance is required, the following steps must be followed.

1. Place the Sweep in the First Guard position.
2. Turn off the logic and machine power breakers on the System Controller.
3. Disconnect the power plugs from the top of the System Controller.
4. Lock Out/Tag Out (LOTO) power to the pinspotter as directed in Section 2.2.1 EDGE Free Fall Lockout/Tagout (LOTO) Procedure starting on page 2-8.
5. Remove guards only as required to perform the maintenance.
6. Once maintenance is complete, replace all guards.

There are many different types of safety guards and labels on a standard pair of QubicaAMF Free Fall Pinspotters. Refer to the following figures-

1. Distributor Drive Housing Guard
2. Distributor Pinion Guard Label
3. Distributor Pinion Guard
4. Distributor Pin Assembly
5. Warning Label (Crossbeam, Distributor Support)
6. Odd End Guard
7. Side Guard Label
8. Pair Isolation Panel
9. IR Sensor Set
10. End Ladder Assembly
11. Hand Hole Guard
12. 2” Warning Label
13. 2” Lane Barrier Label
14. X Frame Label
15. 3” Warning Label
16. 3” No Access Label
17. Odd Lane E-Stop Box
18. 2” LOTO Label
19. 2” No access Label
20. 2” Pin Hook Label
21. 2” Read the Manual Label
22. Even Lane E-Stop/Reset Box
23. Center Guard
24. LBS Guard
25. QubicaAMF Label
26. Center Guard Label
27. PBL Guard
28. System Controller Guard
29. Even End Guard
30. Walkboard Handrail
31. Rear End Guard Odd
32. Rear Controller Guard
33. Rear End Guard Even
34. Common Ladder Assembly
35. Center Guard Mag Interlock

5 - 

7 - 

14 - 

26 - 

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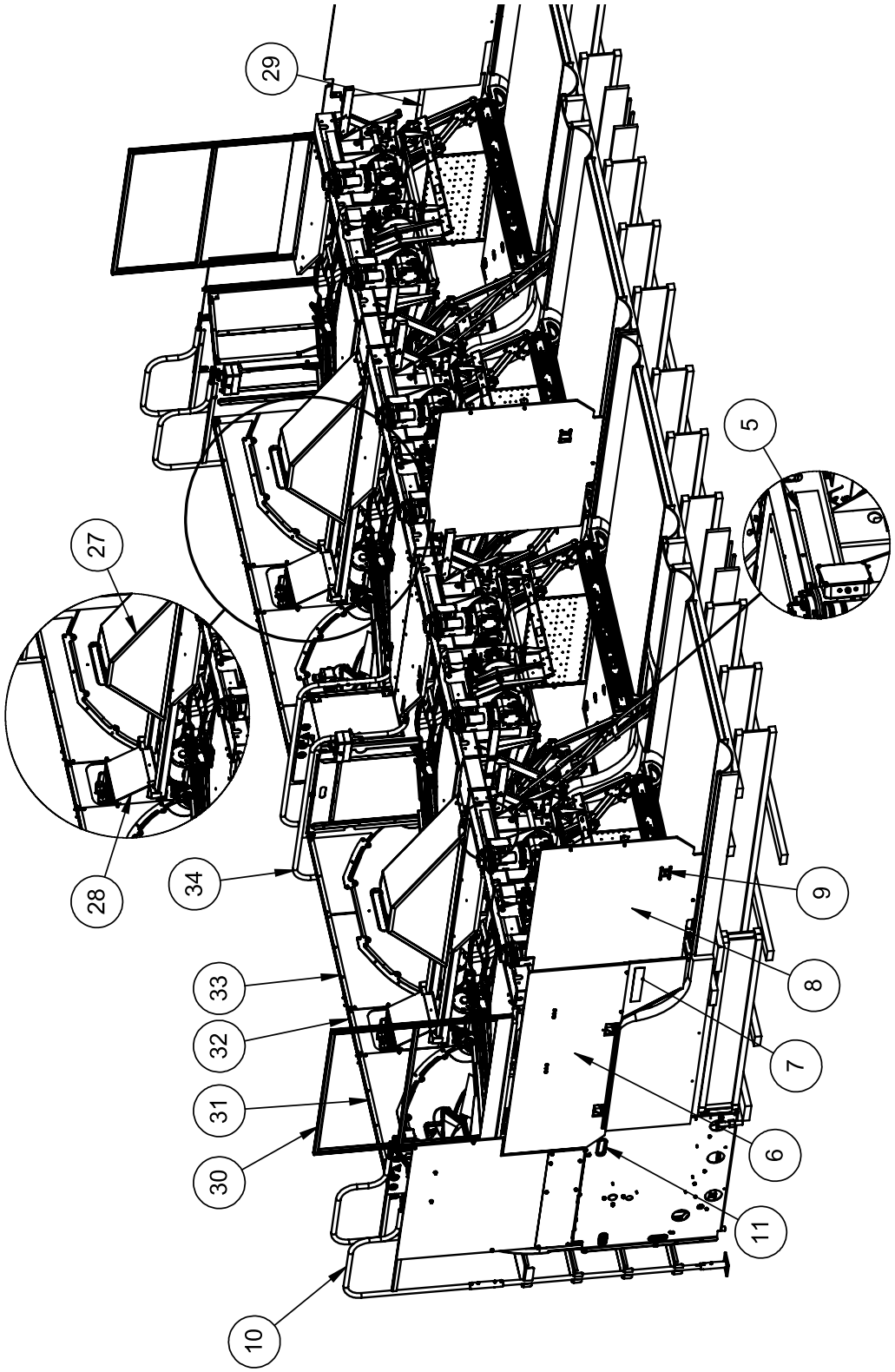

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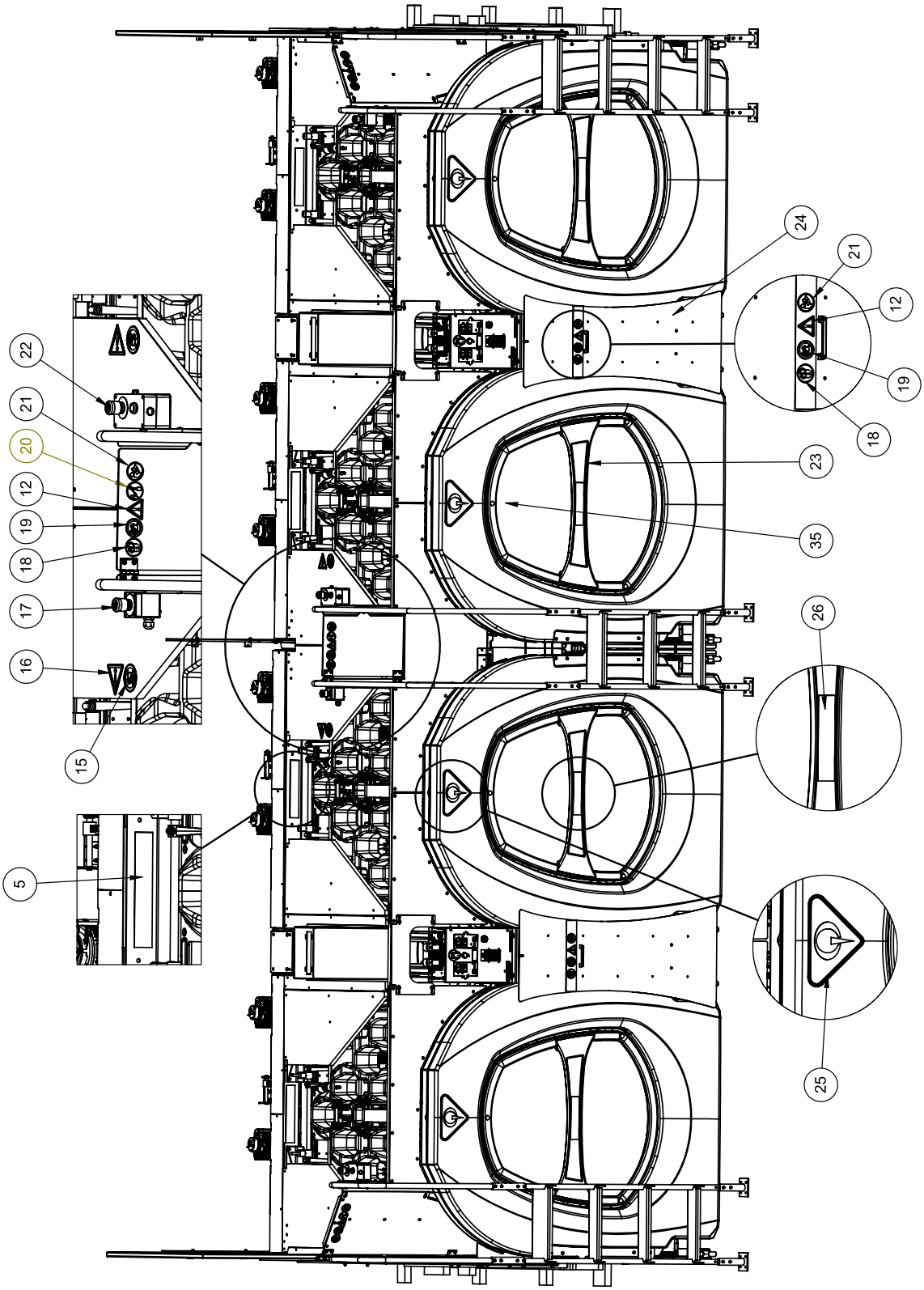

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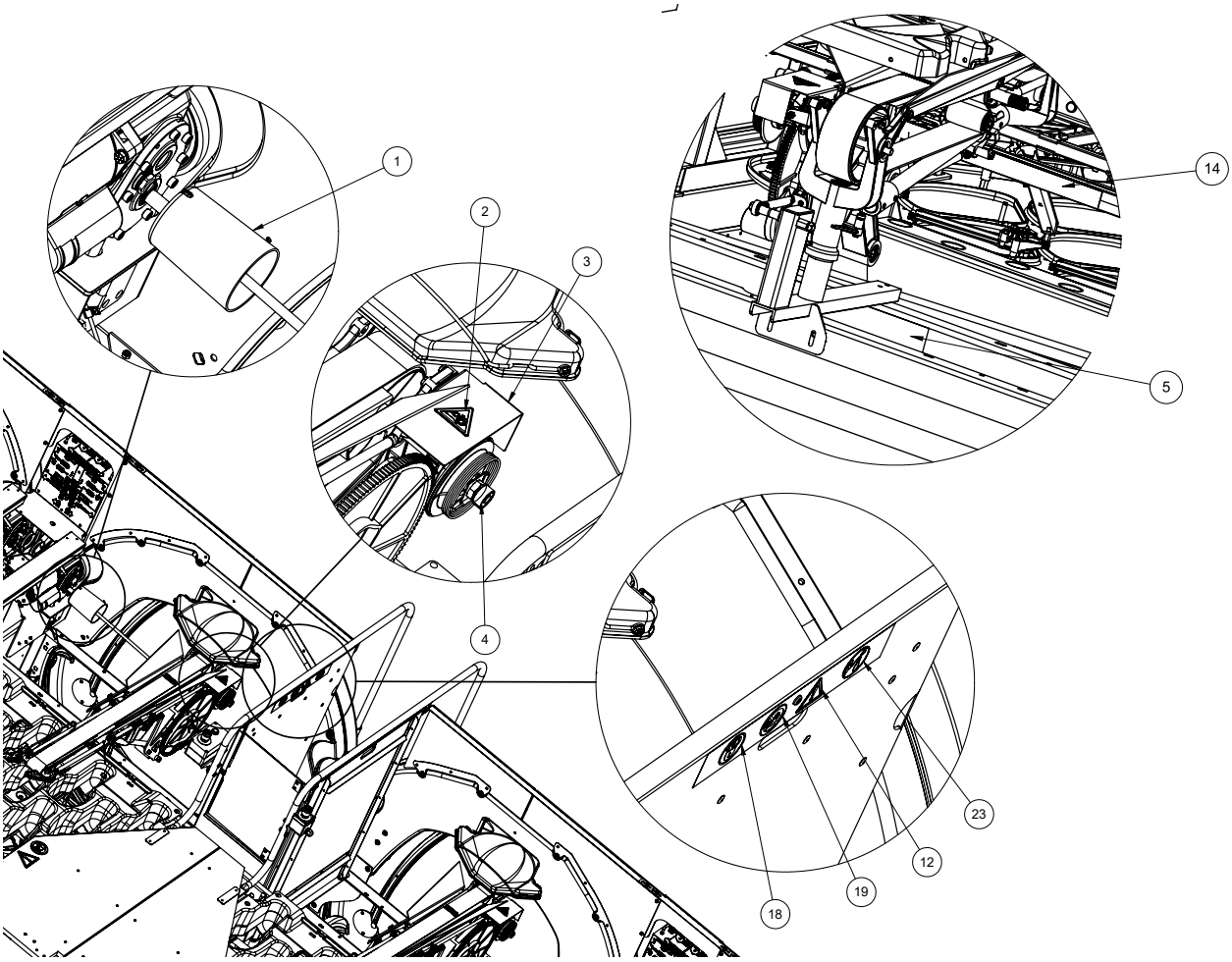

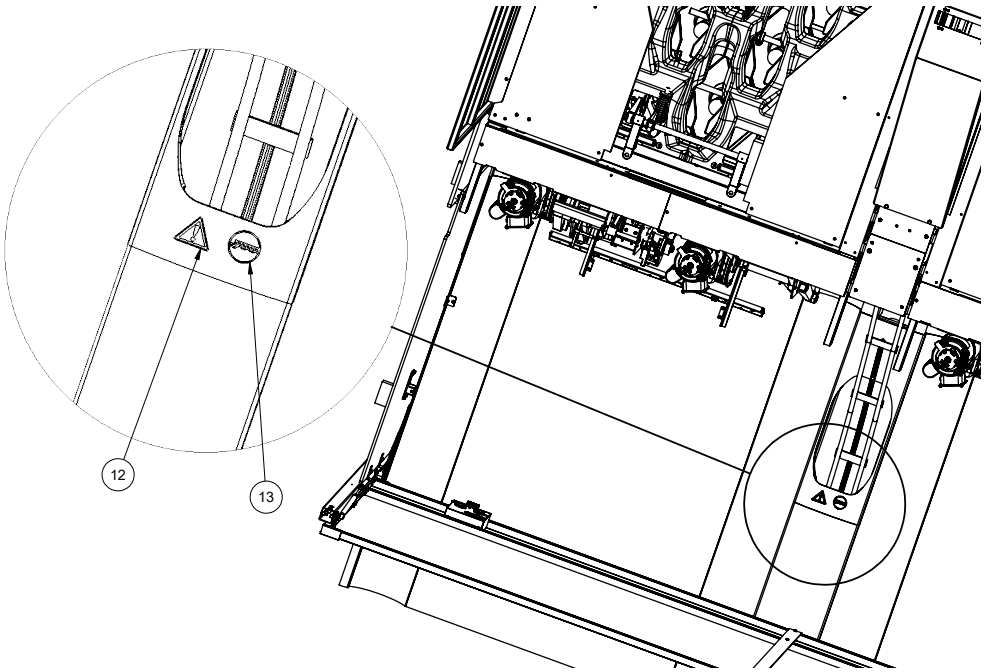

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Section 3 BASIC PINSPOTTER OPERATION

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Table of Contents

Section 3 BASIC PINSPOTTER OPERATION 3-1
3.1. Pinspotter Mechanical Operation 3-5
3.1.1. Four Basic Pinspotter Functions 3-5
3.1.2. Nine Basic Pinspotter Components 3-5
3.1.3. Five Basic Pinspotter Cycles 3-8
3.2. Pinspotter Electrical Operation 3-11
3.2.1. Motors 3-11
3.2.2. Encoders & Switches 3-12
3.2.3. Protection Devices 3-12
3.2.4. Machine Pit Time Delay 3-13
3.2.5. Frame Counters 3-13
3.2.6. Bowler's Pit Signal System 3-13
3.2.7. Tenth Frame Button 3-13
3.2.8. Ball Detector 3-14
3.2.9. CenterPunch Deck Light Operation 3-19
3.3. Electrical Drawings and Pinspotter Ratings 3-20
3.4. Other Supplemental Manuals 3-20

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3.1. Pinspotter Mechanical Operation

3.1.1. Four Basic Pinspotter Functions

The EDGE Free Fall Pinspotter has four basic functions:

1. Stops balls
2. Returns balls
3. Spots pins
4. Respots pins

3.1.2. Nine Basic Pinspotter Components

1. Cushion

The cushion stops the ball and deflects it into the pit area (Figure 3-1).

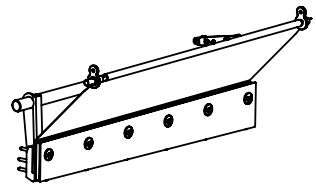

Figure 3-1, Cushion

2. Sweep

The sweep removes fallen pins from the pin deck and adjacent gutters. It also is a guard preventing balls from striking the table while spotting or respotting pins (Figure 3-2).

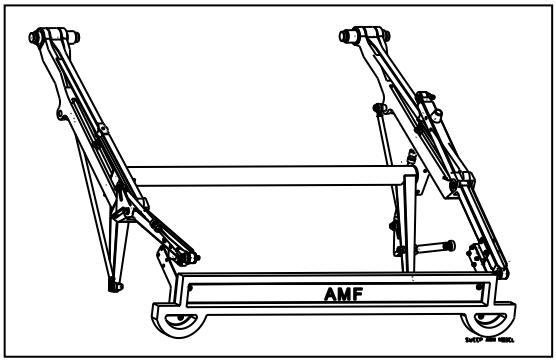

Figure 3-2, Sweep

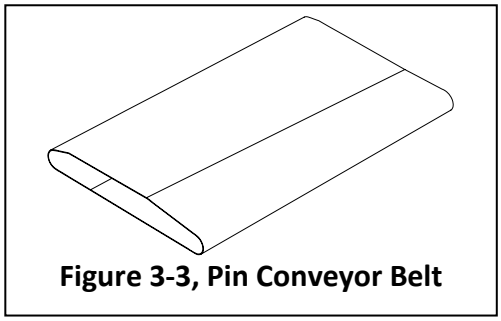

Figure 3-3, Pin Conveyor Belt

3. Pin Conveyer

The pin conveyer (Figure 3-3) is a belt that carries fallen pins to the pin elevator, where they are carried up to the distributor. The underlying bounce board provides support for the pins and guides the ball to the opening to the ball lift.

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4. Pin Elevator

The pin elevator (Edge Performance Lift) carries the pins from the pit area to the distributor. (Figure 3-4)

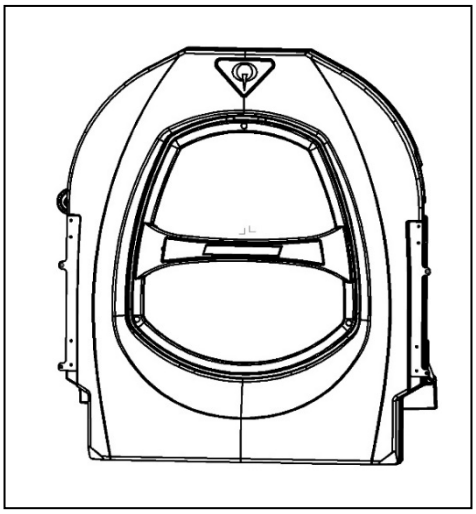

Figure 3-4, EDGE Performance Lift

5. Distributor

The distributor (Figure 3-5) delivers the pins from the pin elevator to the bin. The distributor runs continuously and is driven by the back end motor.

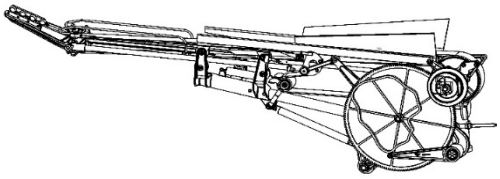

Figure 3-5, Distributor

6. Positive Ball Lift (PBL)

The ball lift (Figure 3-6) lifts the ball high enough to permit gravity to return the ball to the bowler. The ball lift is mounted between the odd and even pinspotters on a pair of lanes.

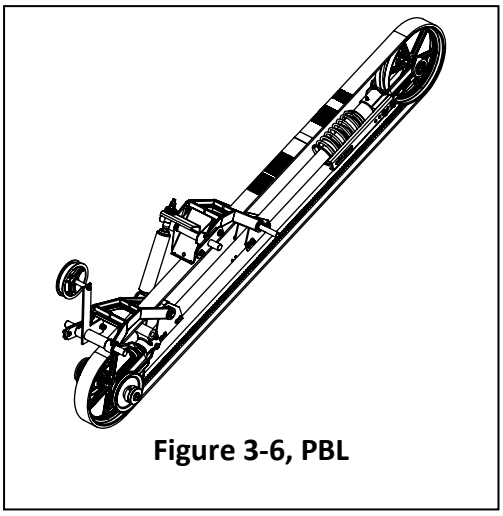

Figure 3-6, PBL

7. Durabin and Shuttle Assemblies

The bin (Figure 3-7) stores pins received from the distributor until ready for spotting. Two sets of pins can be stored in the bin assembly until required.

The shuttle sits just below the bin and keeps the pins in place until actuated, at which point it drops the bottom layer of pins into the spotting cups.

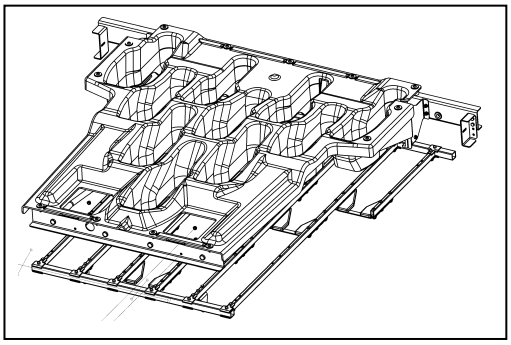

Figure 3-7, Durabin & Shuttle Assembly

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8. Table

The table performs its spotting and respotting functions by employing two major subassemblies:

The **yoke assembly** supports the ten spotting cups (Figure 3-8).

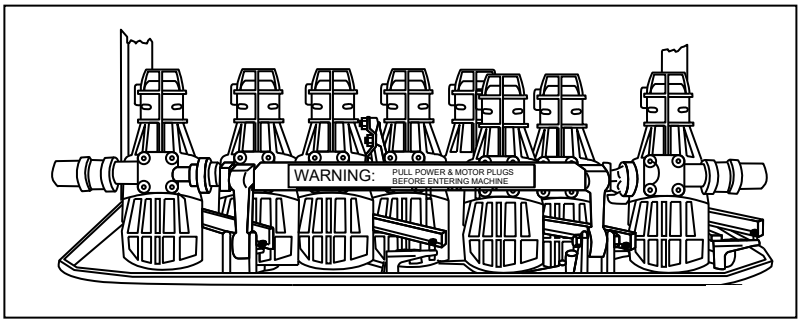

Figure 3-8, Yoke and Spotting Cups

The **table assembly** houses the ten respot cell assemblies (Figures 3-8a & 3-8b).

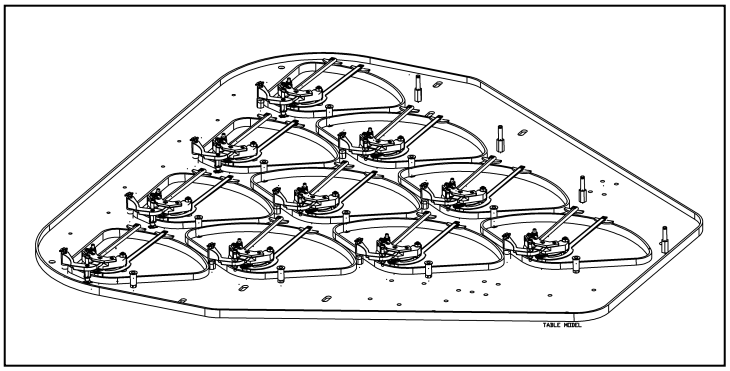

Figure 3-8a, Table

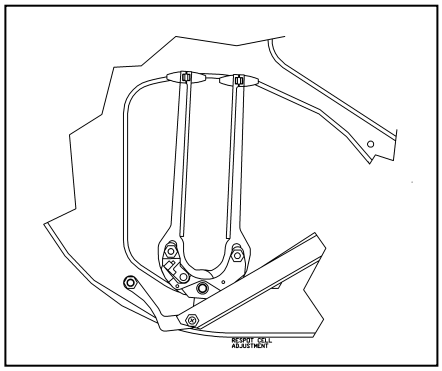

Figure 3-8b, Respot Cell

9. Electrical

The Electrical system includes the system controller, wiring and other components. More information is contained in the Pinspotter Electrical Operation section starting on page 3-11

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3.1.3. Five Basic Pinspotter Cycles

The EDGE Free Fall Pinspotter employs five basic cycles:

1. First Ball Cycle
2. Second Ball Cycle
3. Strike Cycle
4. First Ball Foul Cycle
5. Second Ball Foul Cycle

1. First Ball Cycle

- The machine is ready for the first ball with first ball light on.
- After the bowler rolls the ball, the ball trigger detects the ball passing, signals the system controller, and starts the machine cycle.
- The sweep runs to its down or 1st guard position. It remains here until called upon to sweep the pins into the pit.
- A time delay begins, and at its conclusion the camera detects the pins that remain standing, relays this information to the system controller, and then the table starts its first descent.
- Standing pins are mechanically gripped and raised to a height sufficient for the sweep to pass under them and clear the lane of fallen pins.
- The sweep begins its run-through, pushes fallen pins into the pit, and returns to the 2nd guard position where it stops.
- The table respots the pins that weren't knocked down by the action of the first ball, and the table and sweep return to the home position.
- The second ball light comes on.

2. Second Ball Cycle

- When the second ball is rolled, the ball trigger senses the ball and starts the machine cycle.
- The sweep drops to the 1st guard position. It remains here until called upon to sweep the pins into the pit.
- A time delay begins, and at its conclusion the camera detects the pins that remain standing and relays this information to the system controller.

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- The sweep then performs it sweeping operation and returns to the 2nd guard position.
- At this time, the table receives its spotting signal and the spotting cups swing downward to set up a complete set of pins.
- The table and sweep return to the home position.
- The second ball light goes off, and first ball light stays on.

3. Strike Cycle

- In the strike cycle, the machine components are in the same condition as for the first ball.
- The ball is rolled and the ball trigger senses the ball and starts the machine cycle.
- The sweep drops to the 1st guard position and the time delay starts as in the first ball cycle.
- At the end of the time delay, the camera attempts to detect any pins that remain standing. Since there are none, it feeds this information to the chassis which interprets this as a strike.
- The sweep clears all of the fallen pins from the lane.
- The table begins a spotting operation, descends, and the cups swing down and deposit a full set of pins.
- The table and sweep return to the home position, and the first ball light comes on.

4. First Ball Foul Cycle

- When the ball is rolled and the bowler commits a foul, the foul detector unit operates and prepares the machine for a foul cycle.
- The foul detector unit energizes the foul light on the foul detector cover and rings a buzzer.
- The ball passes the ball trigger which senses the ball and starts the machine cycle.
- The sweep drops to the 1st guard position and then completes its sweeping operation of the pin deck.

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- The table, when full of pins, begins its spotting operation. The table cups swing down and deposit a full set of pins.
- The table and sweep return to the home position. A score of zero pins has been registered.
- The machine is ready for a second ball with the second ball light on.

5. Second Ball Foul Cycle

- Should the bowler commit a foul when delivering the second ball, The foul detector unit operates the foul light and buzzer.
- The sweep clears standing and fallen pins without a scoring time delay and returns to the 2nd guard position.
- A score of zero pins is registered for the second ball.
- The table receives its spotting signal and the spotting cups swing downward to set up a complete set of pins.
- The table and sweep return to the home position, and the first ball light comes on.

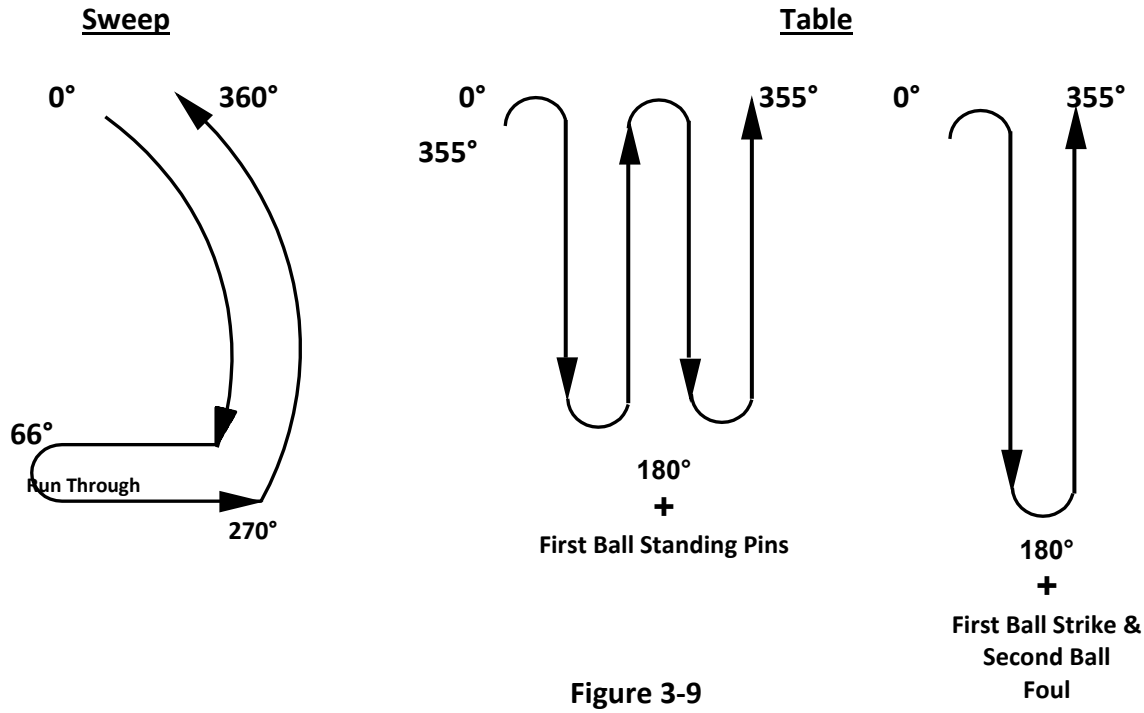

Figure 3-9

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3.2. Pinspotter Electrical Operation

Power to the pinspotter is supplied via the system controller. The system controller has three power inputs: one for each pinspotter's electrical components (the cables with the large blue connectors), and a logic power supply that provides control power for the various machine functions.

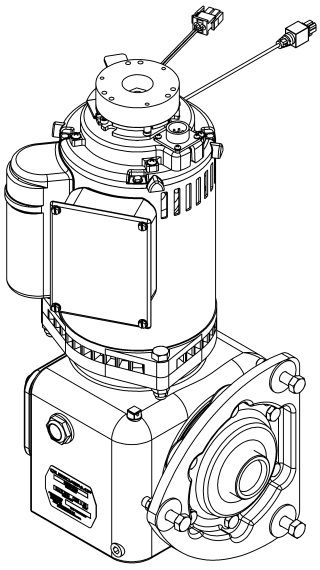
Before turning on control power to the pinspotter system controller, ensure that the red E-stop button on the system controller and at the handrails of the pinspotters are not depressed. Ensure that the IR front barrier beam is active and that both center guards are engaged on the EDGE lifts. These buttons have a lock-in feature that requires that they be pulled out (handrails) or twisted (system controller) to its normal position. If an E-stop button is in the depressed position when system controller logic power is energized, the pinspotters will not turn on and the E-STOP ERROR message will not be displayed. If an E-Stop button is pressed after logic power is turned on, the system controller will sense this and display the E-STOP ERROR message.

3.2.1. Motors

The machine employs three capacitor-start induction motors. All three motors are fractional horsepower units. These motors are designed to operate in a voltage range of 208VAC to 240VAC and are available in 50 Hz or 60 Hz, to match the electrical power in your area. All motors have gear reducer units attached.

Two of the three motors (Figure 3-10) are mounted on the front end and operate the table and sweep. These motors operate intermittently as required and are equipped with a brake and an encoder assembly that is used to provide position indication for the table and sweep. **The Table and Sweep motors are interchangeable.**

The third motor is mounted on the back end and supplies power to drive the pin elevator, the pin conveyer, the ball lift (PBL), and the distributor. This motor runs continuously.



Drawing 3-10

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3.2.2. **Encoders & Switches**

The positions of the Table and Sweep are controlled by the system controller using optical encoders located within the top casting on each motor. The encoders consist of a perforated disk and a light source and sensor assembly. When the motor is energized, the disk, which is attached to the motor shaft, spins. As it spins, the light beam is alternately interrupted and sensed. Each time the light beam is sensed a count is registered. Each count represents a movement of a fraction of a degree of the Table or Sweep drive shafts. From this count, the position of the shaft in degrees is calculated by the system controller and is used to stop the motors at the desired locations.

The Table and Sweep drive shafts each have an encoder and disk assembly mounted on them. These are similar to the ones on the motors except that there is only a single perforation in each of the disks. These perforations are aligned with the light beam when the Table and Sweep are at the home position and provide an absolute indication of when these shafts are correctly positioned for the start of a cycle. The system controller can utilize this information to correct any drift, or accumulation errors, in the counts by resetting the counts to zero when the shafts are at the home position. This self-correcting feature helps to ensure accurate and consistent operation.

The Off Spot Switch

The off spot switch is an electro-mechanical switch that actuates when the table contacts a pin that is standing but has moved off its spot beyond the normal respot range of the table. Its purpose is to prevent damaging the machine if an off-spot condition occurs.

The Optical Bin Switch (BSO)

The optical bin switch is a light-sensing switch that actuates when the #9 pin (the last pin delivered by the distributor) is deposited in the bin. Its purpose is to allow the machine to spot pins only when the bin is full. The optical design eliminates the need for springs and moving parts that could interfere with the proper positioning of the pin in the bin pocket.

3.2.3. **Protection Devices**

In addition to the circuit breakers on the power supply panels and system controller, as well as fuses contained in the system controller (see system controller manual), the back end motor and the table and sweep motors are protected by thermal overload devices called “Klixon” switches that can be identified by a red reset button located on each motor. They shut off the motor when it exceeds a predetermined

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temperature caused by an overload or an electrical fault and must be manually reset after an appropriate cool down period.

3.2.4. **Machine Pit Time Delay**

When the pinspotter is turned off at the Manager's Control Unit (MCU) or Conqueror Front Desk, all functions and motors, **except the pinspotter back end motor**, become inoperative. A time delay allows the back end motor to continue to operate for approximately 60 seconds to enable all of the pins in the pit to be delivered to the bin and for the bowler's ball to be returned to the ball rack. (The machine pit time delay is built into the system controller).

3.2.5. **Frame Counters**

A frame count is provided for the manager's convenience so that the number of frames bowled can be determined. This count is kept in the system controller (total) and Manager's Control Unit (MCU). This unit is located at the manager's control desk.

3.2.6. **Bowler's Pit Signal System**

A signal system is provided on the system controller for the center's convenience so that the bowler has a method of notifying the technician that a machine needs attention. This system is visual through the system controller's remote stack lights.

The bowler's push button (if so equipped), also known as the mechanic call button, is located on the ball rack. When the mechanic call button is pressed, the red and green lights on the system controller's remote stack lights flash alternately. The lights remain on until cleared by the mechanic.

3.2.7. **Tenth Frame Button**

The tenth frame button (if so equipped), located on the end of the ball rack, is provided as a means of cycling the machine when required. Whenever pins are left standing after a game has been completed, the tenth frame button can be operated to signal the machine to set up for the next bowler.

NOTE: Please refer to your respective Ball Return Manual for more Information on functions of the mechanic call and tenth frame buttons.

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3.2.8. Ball Detector

- **Not provided when pinspotters are connecting to QubicaAMF Scoring w/Qvision Camera**

The detector assembly contains two optical emitters/sensors, one for each lane. Two three-position terminal strips are mounted to the base for connecting the cable from the pinspotter system controller to the optical emitters/sensors. Mounting holes are located near the outside edges of the base for securing the detector to the kickbacks. See Figure 3-11.

3.2.8.1. Ball Detector Location

The ball detector and reflector assemblies must be properly aligned in order to function correctly. The design of the detector greatly reduces the possibility of crosstalk. Crosstalk refers to the light from one detector head shining directly into another detector head because of the location or alignment of the reflectors.

Detector Assembly

The detector assembly should be mounted on a rigid board (1 x 6 x 9.5”) that is attached to the nose of the double kickback. The center line of the ball detector should be 51.5 inches (1308mm) from the 7-10 line. On the EDGE Free Fall system controller in the settings menu, the ‘Ball Detector’ setting must be set to ‘BEHIND SWEEP’ or else the sweep can cause the machine to shut down when it passes through the ball detector beam.

Reflectors

The reflectors should be mounted on the nose of the kickback on the opposite side of the lane centered at exactly the same distance from the 7-10 line as the detector head (see Figures 3-11 and 3-12). A reflector assembly consists of a mounting bracket upon which two rectangular pieces of retro reflective tape are mounted, one for each adjacent lane.

LEDs

Inside each detector there are two light emitting diodes, one in each optical emitters/sensors that indicate when the emitter/sensor alignment is correct. If the LEDs are out, the emitter/sensor is in alignment. If the LED is on, no signal is being sensed indicating that the emitter/sensor is out of alignment or the beam is blocked.

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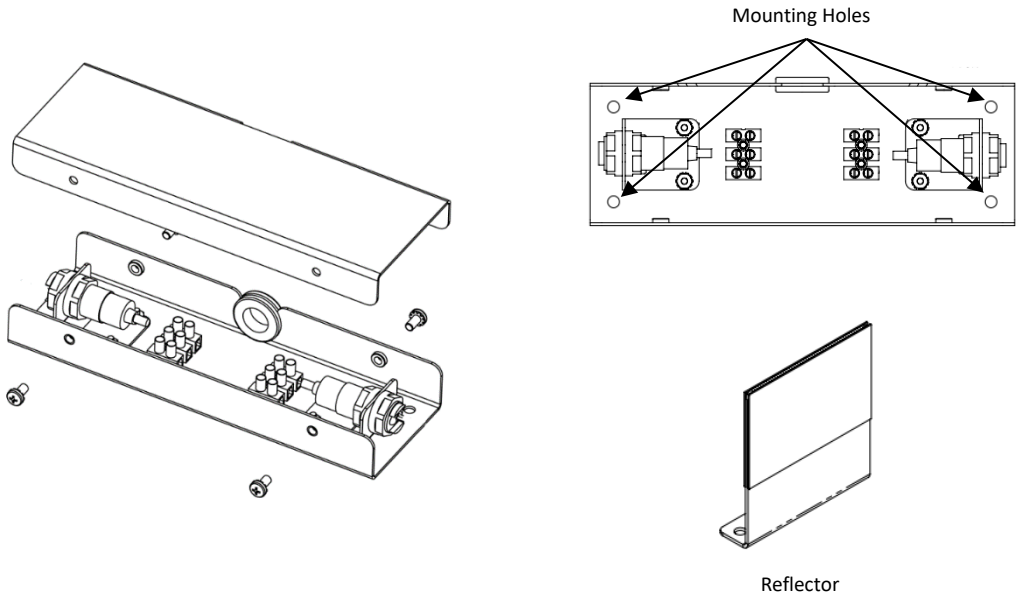

Figure 3-11

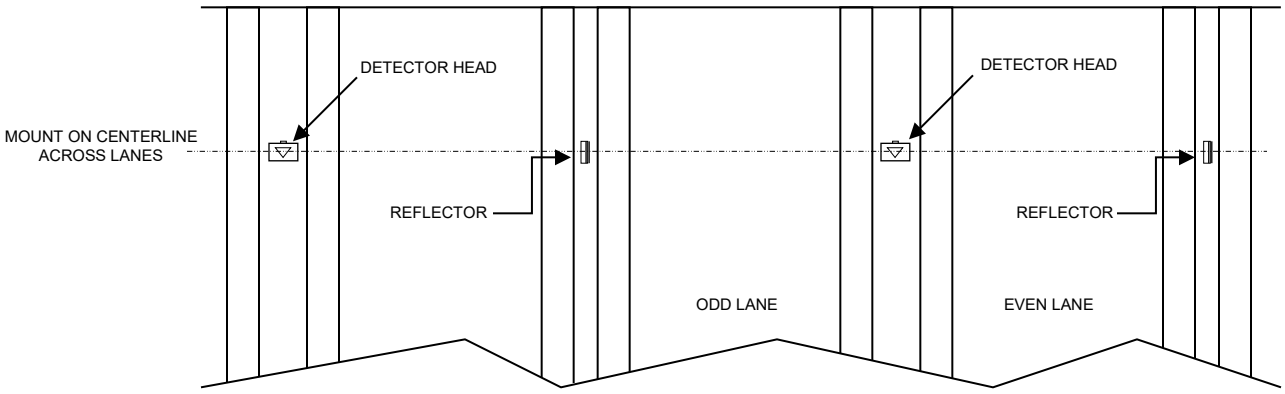

Figure 3-12

3.2.8.2. Ball Detector Cable Connections

The two optical emitters/sensors are prewired to the two terminal strips, one optical emitter/sensor and one terminal strip per lane (odd, even). The wire codes for the optics are 'Blue' – Ground, 'Brown' - +12, and 'Black' – Signal.

The Ball Detect Cable (088-000-508-01) has a Molex 12 position connector that plugs into the EDGE Free Fall system controller and 6 wires (connectors) that will attach to the terminal strips of the ball detector. Two wires are identified with 'Brown' heat shrink tubing, two wires with 'Blue' heat shrink tubing, one wire with an 'ODD' label, and one with an 'EVEN' label.

Insert the ball detect cable thru the grommet.

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Connect the wires with the 'Blue' heat shrink tubing to the terminals that the 'Blue' wire of the optical emitters/sensors is secured to. One wire to each terminal strip.

Do the same for the wires with the 'Brown' heat shrink tubing, securing to the terminals of the 'Brown' wire of the optical emitters/sensors.

Connect the wire marked 'ODD' to the terminal that the 'Black' wire of the optical emitter/sensor for the odd lane, is secured to.

Connect the wire marked 'EVEN' to the terminal that the 'Black' wire of the optical emitter/sensor for the even lane, is secured to.

See Figure 3-13.

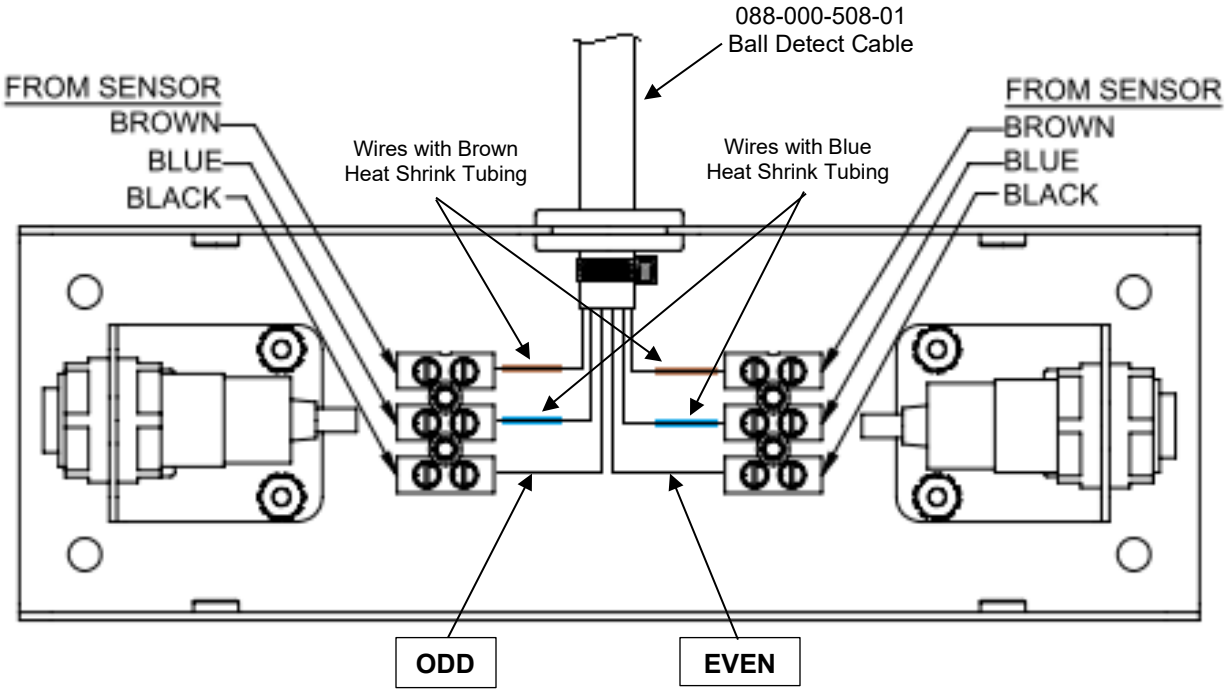

Figure 3-13

Secure a cable tie around the jacket of the 088-000-508-01 cable ½-inch from where the conductors start. The cable tie should be on the inside of the ball detector.

See Figure 3-14.

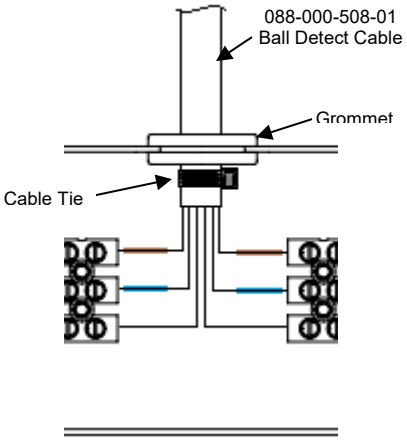

Figure 3-14

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3.2.8.3. Ball Detector Operation

The ball detector is designed to detect and signal the passage of a bowling ball. The detector head contains two optics systems, one monitoring the odd lane and one monitoring the even lane.

As a ball passes the ball detector a signal is sent to the EDGE Free Fall system controller, which after a set time delay (system controller setting 'START SIGNAL DELAY' AUTO to 3.1 seconds) expires, the cycle will start. Recommended 'START SIGNAL DELAY' setting is AUTO.

3.2.8.4. Ball Detector System Test

Make certain that all personnel, tools, and equipment are clear of the machine before restoring power!

Note: This test does not apply to installations containing the SmartGuard™ Safety System.

1. Turn the system controller power ON.
2. Verify that the optical path of the ball detector is not blocked.
3. Turn pinspotter ON.
4. Roll a ball on the lane past the ball detector. Pinspotter should cycle.
5. Roll a ball in the gutter closest to the ball detector. Pinspotter should cycle.
6. Roll a ball in the gutter closest to the reflector. Pinspotter should cycle.
7. Repeat Steps 3 through 6 for the other lane.

If the pinspotter does not cycle:

1. Check the alignment of the optical emitter/sensor to the reflector. LED should be off.
2. Check for loose or misconnected wires at the terminal strip.
3. Check that cable is connected to EDGE Free Fall system controller.

If the pinspotter cycles but errors when the sweep moves past the ball detector, system controller setting 'BALL DETECTOR' must be set to 'BEHIND SWEEP'.

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3.2.8.5. Ball Detector Maintenance & Cleaning Recommendations

The system is designed to operate properly with a significant amount of dust and dirt accumulation on the optics. Periodic cleaning of the reflector surfaces and detector heads will help ensure proper operation.

NOTE: It is recommended that the units be covered during any lane maintenance that generates large amounts of dust and dirt.

1. Use a clean, soft cloth to gently wipe the face of the reflectors on the reflector units as well as the detector heads.

2. If gentle wiping does not remove the dirt, it may be due to grease or oil accumulation. A mild soap (such as dishwashing liquid soap) and water solution may be used. First wash and then gently wipe dry.

Do not use abrasive cleaners or strong solvents as they may permanently damage the surfaces.

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3.2.10. **CenterPunch Deck Light Operation**

The QubicaAMF EDGE Free Fall Pinspotter is equipped with the CenterPunch deck light (see Figure 3-15 for CenterPunch deck light rating, certification, and caution labels) that can be used to provide normal (daylight) illumination or color illumination with one of many preset color choices, as desired.

Figure 3-15

The system is made up of the following components:

- CenterPunch Deck Light Fixture
- Bracket Kit
- Dimmer Cable
- Ground Cable
- Cat5 Daisy Chain Cable (24 AWG wire)

The bracket holds the light fixture in place. The system controller provides power to the CenterPunch deck light.

The CenterPunch deck light for each pinspotter **can be switched to select white or colored light independently of any other pinspotter**. This can be done from the system controller, the Manager's Control Unit (MCU), or from the handheld unit using the *Settings Menu*. Refer to the EDGE Free Fall system controller manual (400-088-009-03), and the MCU manual (400-088-051-02), for specifics on CenterPunch deck light operation. CenterPunch deck light replacement parts are shown in Section 5 of this manual.

Refer to the CenterPunch Deck Lighting Manual (400-275-001-01) for specifics on deck lighting.

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3.3. Electrical Drawings and Pinspotter Ratings

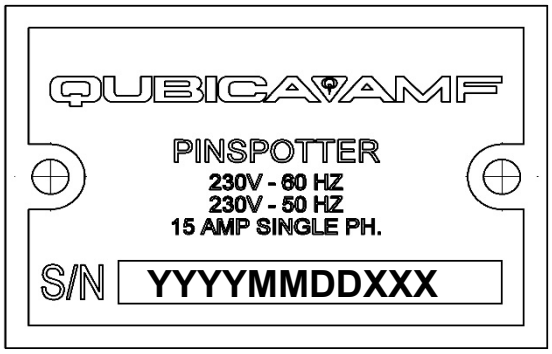

Figure 3-17

Shown above are the pinspotter's voltage, frequency, and current ratings. Also, each machine is serialized with a date-of-manufacture- based serial number.

For information pertaining to the QubicaAMF EDGE Free Fall Pinspotter's electrical connections, refer to Appendix A, QubicaAMF *EDGE Free Fall Pinspotter Wiring Diagram*, 088-200-678-xx.

3.4. Other Supplemental Manuals

Pin Distributor

For information pertaining to the EDGE Free Fall Distributor, refer to Appendix B, *EDGE Free Fall Pin Distributor Manual*, P/N 400-088-121-xx.

Positive Ball Lift (PBL)

For information pertaining to the Positive Ball Lift, refer to Appendix C, Qubica*AMF Pinspotter Positive Ball Lift Manual*, 400-088-011-xx.

System Controller (Chassis)

For information pertaining to the operation of the pinspotter system controller, refer to Appendix D, *EDGE Free Fall System Controller Manual*, P/N 400-088-009-xx.

Motors & Gearboxes

For information pertaining to the front end and backend gear-motor assemblies, refer to Appendix E, *EDGE Free Fall Motor and Gearbox Manual*, P/N 400-088-038-xx.

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Edge Performance Lift

For information pertaining to the EDGE Performance Lift, refer to Appendix F, *EDGE Performance Lift Pinspotter Manual Supplement*, P/N 400-088-091-xx.

Manager's Control Unit

For information pertaining to the Manager's Control Unit (MCU), refer to Appendix G, *Manager's Control Unit (MCU) Manual*, P/N 400-088-051-xx.

Radaray

For information pertaining to the Radaray Foul Detector, refer to Appendix H, EDGE *Radaray anual*, P/N 400-088-006-xx.

Enhanced Guarding

For information pertaining to the EDGE Free Fall Enhanced Guarding, refer to Appendix I, EDGE Free Fall Enhanced Guarding Manual, P/N 400-088-099-xx.

Pin Sensing Camera

For information pertaining to the scoring camera, refer to Appendix J, *QV-3000 Camera Manual* (400-232-001-xx). Note: This manual is relevant only when the center does not have automatic scoring.

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Section 4A SERVICE

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Contents

Section 4 A SERVICE 4-1
4.1. Service Tools 4-5
4.1.1. Service Tool Kits 4-5
4.1.1.1. Deluxe Tool Kit 4-5
4.1.1.3. EDGE Free Fall Steel Table Tool Kit 4-6
4.1.2. Service Tools 4-6
4.1.2.1. Motor Crank 4-6
4.1.2.2. Home and Encoder Tester 4-6
4.1.2.3. Pit Conveyor Belt Installation Tool 4-7
4.1.2.4. Clipper Belt Lacer (Distributor Belt) 4-8
4.1.2.5. Crimping Tool (Typical) 4-9
4.1.2.6. Socket and Pin Extraction Tools 4-10
4.2. Machine Adjustments 4-11
4.2.1. Machine Height and Position Adjustments 4-11
4.2.2. Table Adjustments 4-13
4.2.2.1. Tie Rod Adjustment 4-13
4.2.2.2. Table Leg Screw Adjustment 4-13
4.2.2.3. Table Level and Height Adjustments 4-14
4.2.2.4. Positioning (Flagging) the Table 4-16
4.2.2.5. Spotting and Adjusting Pins 4-18
4.2.2.6. Individual Spotting Cup ON-SPOT Adjustments 4-19
4.2.2.7. Spotting Cup Toe-in 4-19
4.2.2.8. Final Spot Checks 4-19
4.2.2.9. Table Off-Spot Switch Operation and Adjustment 4-20
4.2.2.10. Table and Respot Cell Operation 4-22
4.2.2.11. Table Home Position Adjustment 4-23
4.2.2.12. Table Drive Eccentric Operation 4-24
4.2.2.13. Spotting Linkage Adjustments 4-25
4.2.2.14. Yoke Spring Adjustment 4-27
4.2.2.15. Spot and Respot Lever Spring Removal or Replacement 4-28

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4.2.2.16. Yoke Assembly (X-Frame) Removal 4-30
4.2.2.17. Respot Cell Operation & Adjustments 4-31
4.2.2.18. Table Motor and Gearbox Removal 4-36
4.2.3. Sweep Operation and Adjustments 4-37
4.2.3.1. Sweep Adjustments 4-37
4.2.3.2. Sweep Height at 1st Guard 4-38
4.2.3.3. Sweep Height at the 4, 5 and 6 Spots and Stroke Length 4-38
4.2.3.4. Sweep Home Position Adjustment 4-39
4.2.3.5. 1st and 2nd Guard Positions 4-41
4.2.3.6. Sweep Motor and Gearbox Removal 4-41
4.2.4. Positive Ball Lift 4-42
4.2.5. Distributor 4-43
4.2.6. Durabin and Shuttle Operation & Adjustment 4-44
4.2.6.1. Durabin and Shuttle Operation 4-44
4.2.6.2. Durabin and Shuttle Adjustments 4-44
4.2.6.3. Bin Switch Operation 4-46
4.2.6.4. Optical Bin Switch Adjustment 4-46
4.2.7. Cushion Operation and Adjustments 4-48
4.2.7.1. Cushion Shock Absorber Adjustment 4-48
4.2.7.2. Cushion Removal 4-49
4.2.7.3. Replacing Urethane Rivets 4-51
4.2.7.4. Replacing Cushion Components 4-52
4.2.8. Pin Conveyor Belt & Adjustments 4-53
4.2.8.1. Belt Removal Procedure 4-53
4.2.8.2. Belt Replacement Procedure 4-54
4.3. Critical Measurements 4-57

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4.1. Service Tools

4.1.1. Service Tool Kits

There are a couple of tool kits available for servicing the EDGE Free Fall Pinspotter: The Deluxe Tool Kit, P/N 784-528-013, and the EDGE Free Fall Steel Table Tool Kit, P/N 784-528-014. Section 4.1.1.1 lists the tools that are included in the Deluxe Tool Kit, section 4.1.1.2 lists the tools that are included in the Steel Table Tool Kit.

4.1.1.1. Deluxe Tool Kit

PART #	DESCRIPTION	PART #	DESCRIPTION
030-004-031	EXTRACTING TOOL, MOTOR PLUG	789-511-027	SOCKET SET 1/4 DRIVE, 22 PCS
088-000-204	EXTRACTING TOOL, CHASSIS PLUGS	789-511-028	SOCKET SET; 6 & 12 PT
088-000-207	MINI-FIT PIN EXTRACTOR	789-512-028	UNIVERSAL 1/4 DRIVE
088-000-210	MINI-FIT PIN CRIMPER	789-512-029	UNIVERSAL 3/8 DRIVE
088-001-635	HOME AND ENCODER TESTER	791-006-007	DIGITAL MULTIMETER
714-501-001	PADLOCK, KEYED ALIKE	792-002-007	SNAP RING PLIERS
780-501-011	5/32 HEX BIT SOCKET, 3/8 DRIVE	792-005-005	TOOL BOX
780-503-014	3/8 DRIVE HEX BIT SET, 7 PCS	792-026-028	POWER RETURN TAPE; 13mm X 3M
780-503-015	4MM ALLEN HEX 3/8" SOCKET	792-029-031	WIRE STRIPPER/CUTTER; 5"
782-501-001	EXTENSION BAR, CR-V 3/8" DRIVE	792-512-019	CRIMPING TOOL
783-501-001	BALL PEEN HAMMER, 16 OZ	792-517-037	TORPEDO LEVEL; 9"
783-502-002	HAMMER, SOFT FACE, 12 OZ	793-501-003	ADJUSTABLE WRENCH; 10"
785-005-005	GREASE GUN	793-503-017	HEX KEY SET, 13 PCS
786-501-001	PLIER, TONGUE&GROOVE, 10"	793-503-051	HEX KEY SET, 9 PCS
786-502-002	PLIERS, NEEDLE NOSE, 6"	793-506-010	COMBINATION WRENCH SET; 11 PC
786-503-003	PLIERS, SLIP JOINT, 6"	793-506-011	COMBINATION WRENCH; 17mm
786-504-004	PLIERS, DIAGONAL CUTTING, 7"	793-510-057	WRENCH SET; RATCHETING, 7 PC
787-001-006	PIN PUNCH SET	793-513-048	TORQUE WRENCH
788-504-004	HACKSAW; ADJ; 10"-12"	793-514-048	LOCKING PLIERS; 10"
789-023-001	SCREWDRIVER SET; 6 PC	793-516-001	ALLEN WRENCH, 4mm X 6.00
789-510-055	SOCKET;12PT STD ;10 mm X 3/8"	793-516-002	ALLEN WRENCH; 6mm X 6"
789-510-056	10mm COMBINATION WRENCH		

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4.1.1.3. EDGE Free Fall Steel Table Tool Kit

PART #	DESCRIPTION	PART #	DESCRIPTION
030-003-542	CLIPPER BELT LACER	792-501-001	CARPET REMOVAL PINS
070-006-519	PINSPOTTER GAGE	792-502-002	FLAG, CARPET TOOL
088-001-216	PSP MULTIGAGE, FRAME SWEEP DIST	792-505-005	SPRING PULLER
088-001-217	PSP GAGE, TOKE TOE	792-505-036	SPRING PULLER STEEL TBL
090-005-525	LOCATING TOOL; STEEL TABLE	793-511-045	ADJUSTABLE SPANNER WRENCH
784-003-000	HANDLE CARPET TOOL		

4.1.2. Service Tools

4.1.2.1. Motor Crank

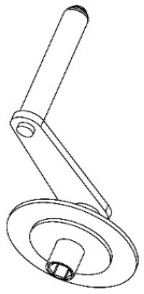

Figure 4.1-1c

The EDGE Free Fall Pinspotter's table and sweep drive motors can be operated manually to position the table or sweep for maintenance or adjustment. The drive motors contain a brake that must be manually released before hand cranking the motor, and will automatically re-engage when the brake lever, located at the top of each motor, is released. A new motor crank tool (P/N 088-000-033) is also provided. The design of the tool prevents insertion of the tool with drive power connected. **Use only the motor crank tool provided with the pinspotter for manual operation of the table and sweep drive motors.**

4.1.2.2. Home and Encoder Tester

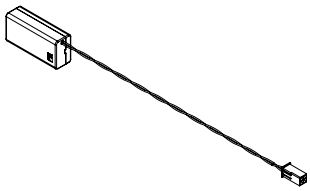

Figure 4.1-1d - Home/Encoder Tester

The Home and Encoder Tester (088-001-635) is used with the EDGE Free Fall to test and adjust the sensors when the pinspotters are Locked/Tagged Out (LOTO). The device utilizes a 9V battery to enable it to test the functionality of these sensors.

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4.1.2.3. Pit Conveyor Belt Installation Tool

The Pit Conveyor Belt installation tool is used to remove spring tension from the belt roller for replacement of the belt, belt roller, bounce board, and other related parts. With the pinspotter in Lockout/Tagout (LOTO), insert the tool between the tail plank and the belt near one end of the roller, and using the tool as a lever, apply pressure towards the rear of the machine until you can insert a belt removing pin (P/N 792-501-001) into the hole provided in the side plate. Repeat this procedure for the other end of the roller. The front roller can now be removed.

Because of the danger involved should the belt removing pins be accidentally knocked out while working in the pit, the belt installation tool can be used in conjunction with the flag (P/N 792-502-002) to remove spring tension from the front roller bearing supports. Attach the flag to the bearing support as shown in Figure 4.1-2, apply rearward pressure, remove the belt removing pin, and carefully let off pressure until the bearing support is resting against the tail plank. Repeat for the other side. **Perform this procedure with caution as the bearing supports are under considerable spring tension.**

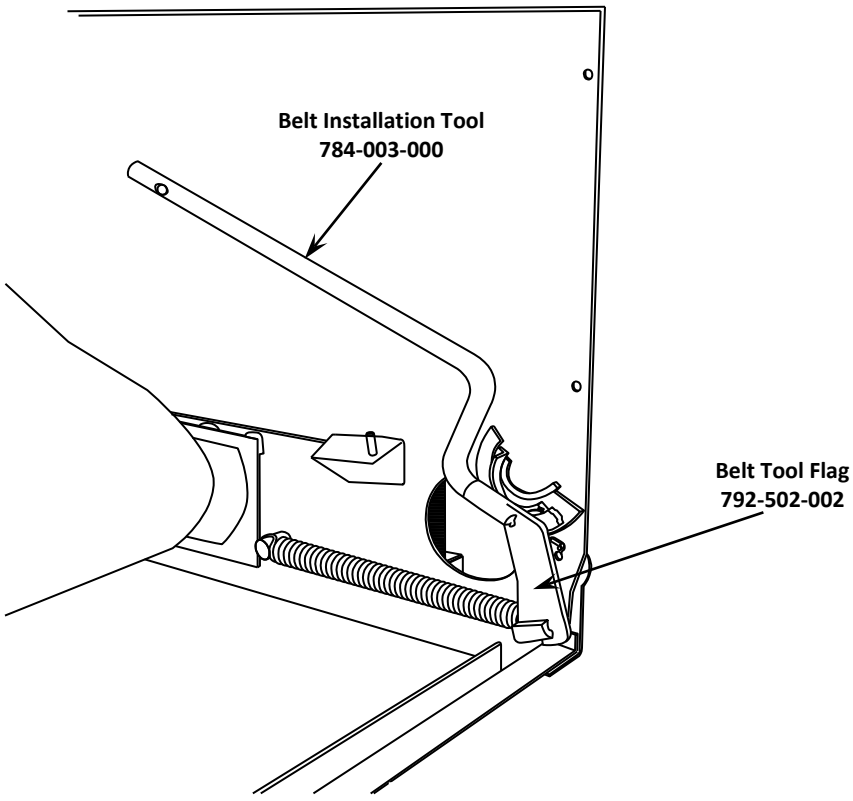

Figure 4.1-2, Pit Conveyor Belt Installation Tool in Use

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4.1.2.4. Clipper Belt Lacer (Distributor Belt)

The clipper belt lacer is provided to help the mechanic manufacture replacement distributor belts. The optimum belt length can vary slightly from distributor to distributor. If possible, match the existing belt length. The belt lacing will add approximately 1/4 inch to the overall, installed belt length. Laced belts are also available from QubicaAMF. To make a belt, refer to the *EDGE Free Fall Pinspotter Pin Distributor Manual*, 400-088-121-01.

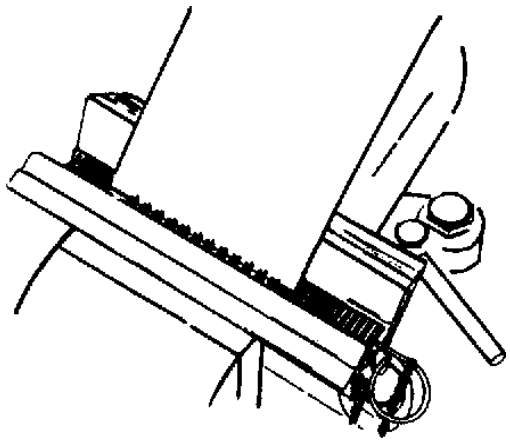

Figure 4.1-2.4 Clipper Belt Lacer

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4.1.2.5. Crimping Tool (Typical)

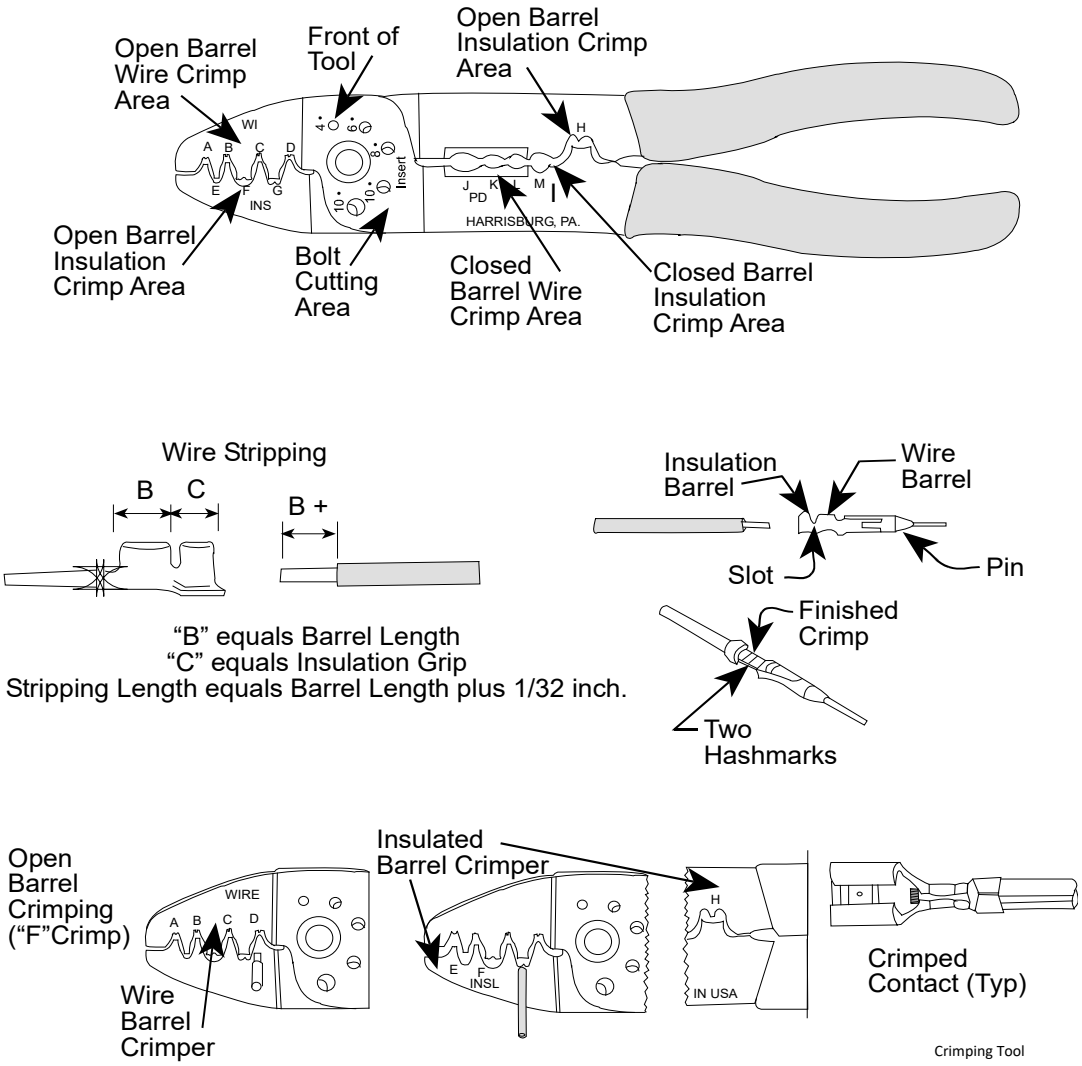

Figure 4.1-3

Wire Barrel - Position the contact in the appropriate crimp area (A, B, C, or D) with the wire barrel opening facing the letter. Squeeze the tool handles just enough for the jaws to hold the contact in place. Insert a properly stripped wire into the wire barrel. Hold the wire in place and squeeze the tool handles to finish the crimp.

Insulation Barrel - Position the contact and wire in the appropriate insulation crimp area (E, F, G, or H) with the insulation barrel opening facing the letter. Hold the contact and wire in place and squeeze the tool handles to finish the crimp.

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4.1.2.6. Socket and Pin Extraction Tools

The socket and pin extraction tool is designed to allow removal of pins and sockets from various connectors for repair or replacement. This tool is included in the Deluxe Tool Kit and is available from QubicaAMF by ordering P/N 030-004-031. Use the tool as shown in Figure 4.1-4 below.

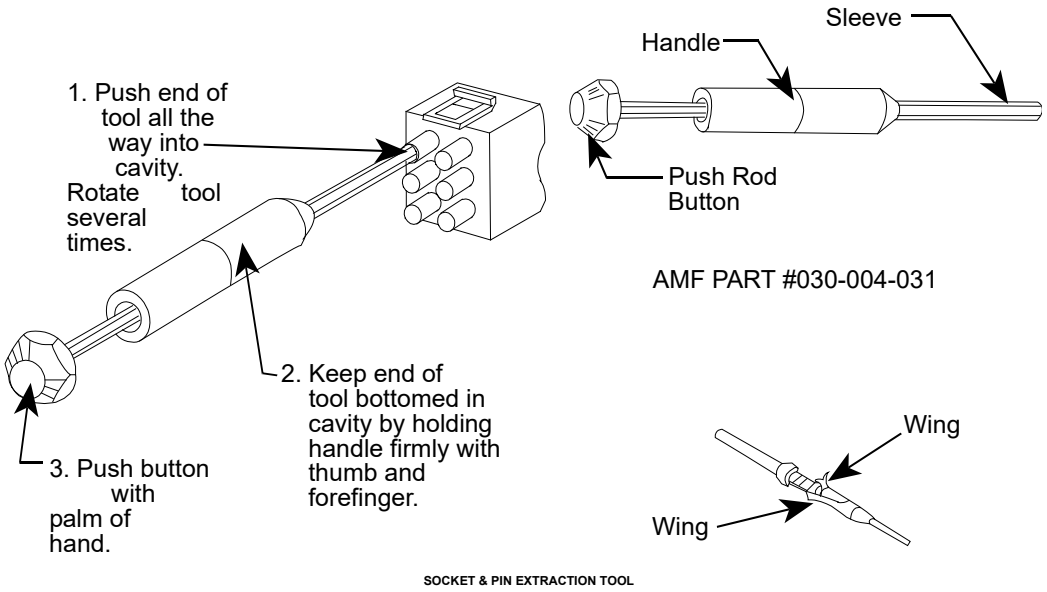

Figure 4.1-4, Pin Extracting Tool

NOTE: When a pin or socket is removed from an "M" type plug, it will be necessary to flare out the two wings (Figure 4.1-4) which have been flattened by the extraction tool. This action is necessary so that the terminal seats properly and will not back out of the plug when reinstalled. Care should also be exercised to prevent damage to the ring at the rear of the terminal. This area must remain circular to promote correct alignment within the plug.

Other tools of note used with socket pins are

030-004-031 Pin Extracting Tool
088-000-207 Mini-fit Pin Extractor
088-000-204 Pin Pusher (extracting tool)

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4.2. **Machine Adjustments**

There are two types of adjustments that can be made to a pinspotter: 1) electronic setpoint adjustments, and 2) mechanical adjustments.

Setpoint adjustments are made from the MCU, the system controller, or the handheld unit. Refer to the MCU manual, P/N 400-088-051-01, for details on MCU operation and the system controller manual, P/N 400-088-009-02, for system controller and handheld unit operation.

It is important to understand how the system controller implements setpoint changes. The Table and Sweep drive motors have encoders that constantly feed Table and Sweep position information to the system controller. Whenever there is a difference between the actual stopping point of the Table or Sweep and the associated setpoint, the system controller will attempt to automatically correct the stopping point.

So, if for example the Table overshoots the home position by three degrees, it could take a couple of table cycles to make the correction. The same is true whenever a setpoint is changed. If the Sweep's 1st Guard setpoint is changed from 66° to 70°, it could take a couple of Sweep cycles for the setpoint change to be fully realized.

It is important for the mechanic to understand that the correction might not be immediate and to not adjust the setpoint further until the machine has cycled enough times for the change to be fully implemented.

If the table or sweep consistently overshoots its stopping point, if an out of range warning message appears on the system controller display, or if the table backs up when stopping at the home position, a brake failure may have occurred.

4.2.1. **Machine Height and Position Adjustments**

Refer to the *Critical Measurements* sheets in section 4.3 for a listing of the most important pinspotter installation parameters. Performing recommended maintenance and maintaining these critical settings will help you achieve optimal pinspotter operation.

Before making any table adjustments you must check the machine height and position relative to the pin deck.

1. Verify that the vertical distance from the pin deck to the underside of the frame is 18-7/8 ± 1/8 inches at all four corners. This measurement should be as nearly the same as possible at each corner, i.e., not 18-3/4 inches at one corner and 19 inches at another, although both numbers are within limits. A level or straight edge can be used to help make this measurement (see Figure 4.2-1). Making adjustments may also require adjustment of the back end's large leveling jack screws.

2. From a line running through the center of the 7 and 10 spots (known as the 7-10 line), it should measure 13-5/8 inches to the front of the front vertical member of the front end

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frame (see **A** in Figure 4.2-1). Adjust by loosening the unistrut jam nuts and sliding the entire unit forward or backward, as necessary, and then tighten the jam nuts.

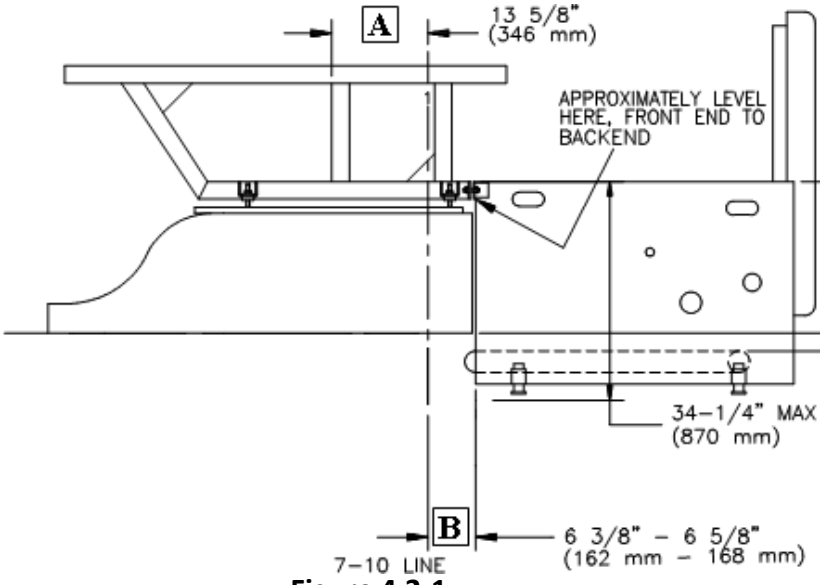

Figure 4.2-1

3. From the 7-10 line it should measure 6-1/2 ± 1/8 inches to the front edge of the kickback plates (see **B** in Figure 4.2-1). This distance can be adjusted by adding or removing washers from the junction of the front-end and back-end units.

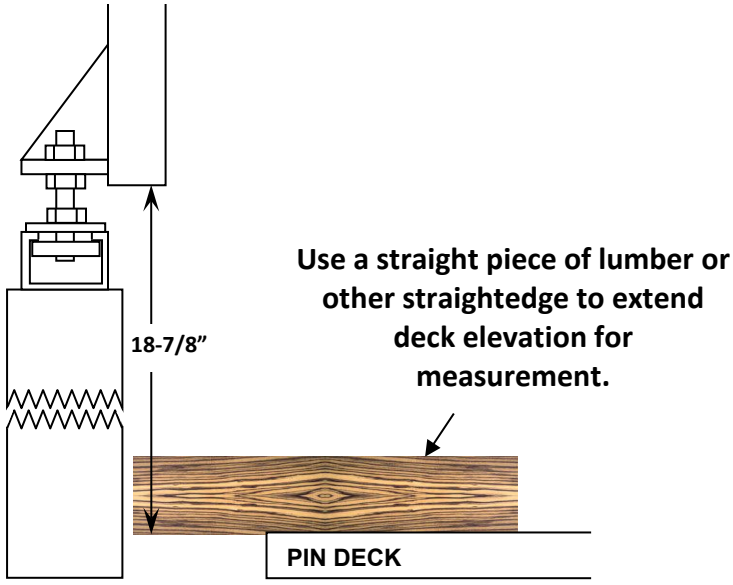

Figure 4.2-2

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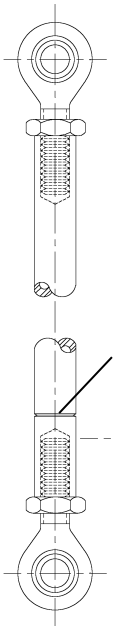
4.2.2. Table Adjustments

4.2.2.1. Tie Rod Adjustment

Throughout this section, references to adjusting the various tie rods are made. A tie rod (Figure 4.2-3) is a device that consists of two threaded sections and a center section into which the threaded sections fit. On most tie rods, one threaded section has standard right-hand threads, and the other threaded section has left-hand threads. Turning the center section increases or decreases the tie rod's overall length. **The end with the left-hand threads can be identified by a line scribed around the circumference of the center section near the end.** It is helpful to know which end is left threaded because there is a jam nut on each of the threaded sections, and the left-threaded nut must be turned opposite the normal direction to loosen. A few tie rods have right-hand threads on both ends to prevent the tie rod from going out of adjustment during operation, and at least one end must be disconnected for it to be adjusted. Loosen the jam nuts before making any tie rod adjustments, and tighten them after adjustments have been made.



Tie Rod

Figure 4.2-3

The following Table adjustments are presented in the order in which they should be performed for optimal results.

4.2.2.2. Table Leg Screw Adjustment

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Remove table motor power cord.
9. Crank table motor counterclockwise to lower table to respot height.
10. Loosen the jam nuts on both table leg adjustment screws (Figure 4.2-4). Back out the screw on the 10 pin side front leg, so it no longer contacts the bracket.

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11. While holding the #1 spotting cup up and towards the back of the machine, measure the gap between the adjustment screw and the bracket on the 7-pin side. Use the larger end (yoke end) of the yoke/toe PSP gauge (088-001-217) or a 3/16" (5mm) Allen hex wrench to adjust this gap to 3/16 of an inch (5 mm), and tighten the jam nut (See Figure 4.2-4). The 088-001-217 gauge or 3/16" (5mm) Allen wrench should just fit under the front edge of the adjustment screw, but not pass all the way through when correctly fit.

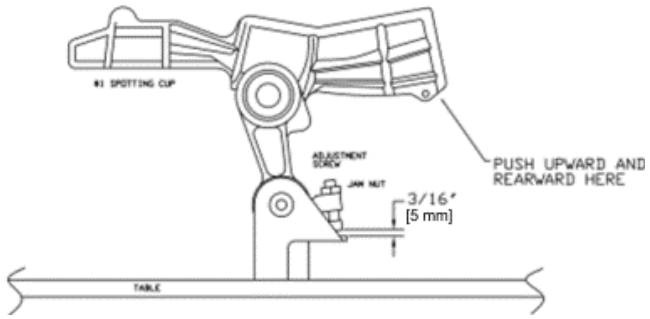

Figure 4.2-4

12. Release the #1 spotting cup and allow the cups to return to a resting state. The square head of the 7-pin side adjustment screw should rest on the leg bracket. Without losing the adjustment, tighten the 7-pin side jam nut.
13. Turn the 10-pin side adjustment screw until the head of the screw touches the table leg bracket. Continue turning the screw until it is finger tight. Do not use a wrench.
14. Tighten the jam nut for the adjustment screw on the 10-pin side.
15. Push the #1 cup upward and rearward again to double-check the 3/16" gap.
16. Verify that each cup width is between 4-1/8 and 4-1/4 inches (105-108 mm) using the pinspotter gauge tool (070-006-519) (allowing a tolerance of +1/8 inch [+3 mm] of the tool's length). Adjust if necessary.

4.2.2.3. Table Level and Height Adjustments

1. Crank the table up (counter-clockwise), engage the spotting latch and then lower the table to it's lowest position (The table drive shaft, eccentric stud and clevis bolt should all line up as shown in figure 4.2-5).

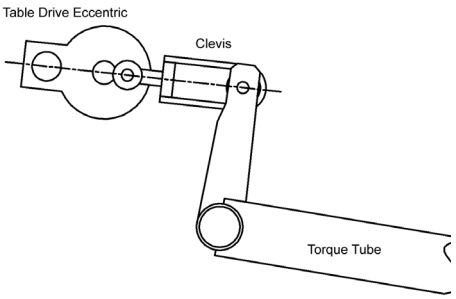

Figure 4.2-5

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2. Momentarily push down on the table where it attaches to the support arms to ensure it is all the way down. Lay the pinspotter gauge tool (Figure 4.2-6) flat on the pin deck to check the height of the table. The tool should just fit (without touching) between the pin deck and button head screw in the center of each wing bracket at the 1, 8, and 10-pin openings. If the screw head touches the tool, adjust the table upwards in half-turn increments of the clevis as specified in step 5.1.10. The desired height is a gap of 5/16 inch (8 mm) between each screw head and the pin deck (see Figure 4.2-7).

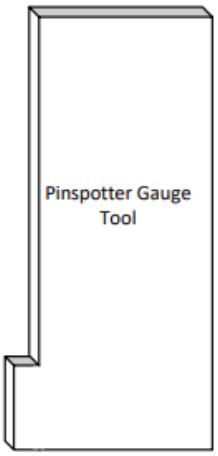

Figure 4.2-6

   a. To adjust the Table height, support the table by placing a 2x4 on the pin deck and lowering the table onto it until there is no tension on the clevis.

   b. Remove the clevis bolt, bearing, and spacers.

   c. To raise the height of the table, screw the clevis onto the threaded stud further. This shortens the clevis assembly's overall length. To lower the height of the table, lengthen (unscrew) the clevis assembly. Each half turn of the clevis will result in approximately a 1/8-inch [3 mm] change in table height.

   d. Reinstall the bearing, spacers, and clevis bolt.

   e. Manually raise the table and remove the support.

   f. Lower the table and recheck the table height with the gauge tool.

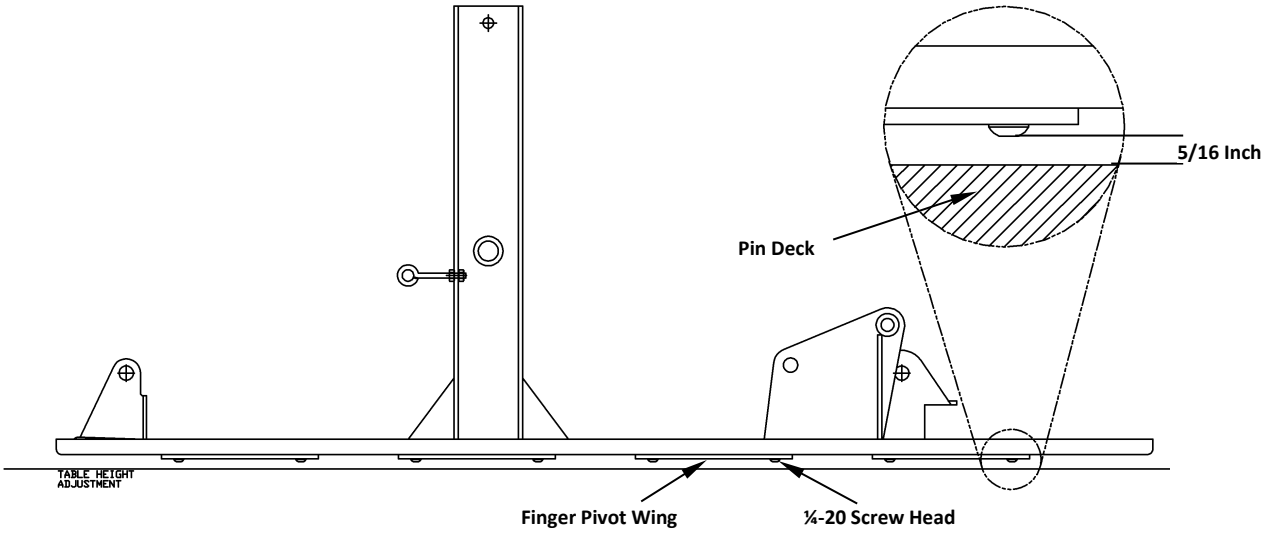

Figure 4.2-7

NOTE: Whenever lowering the table to make adjustments, momentarily push down on the table at the support arms (with nothing under the table) to ensure the table is all the way down. This will result in a more accurate adjustment.

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3. To obtain the same clearance between the three button head screws and the pin deck proceed as follows:
    a. Loosen the jam nuts on the table leveling rods.
    b. Adjust the leveling rods to obtain an equal amount of clearance at all 3 locations (1, 8 and 10).
    c. Repeat steps 2a through 2f as necessary to obtain a 5/16-inch gap (thickness of tool) between the pin deck and the head of the button head screws at the 1, 8 and 10 pin positions.
    d. If it is not possible to obtain 5/16” all the way around the table, it may be necessary to shim under one of the table uprights with C-washers.
    e. Once the table is level and 5/16” above the pin deck, hold the leveling rods secure and tighten the jam nuts.
4. As a double check, push down on the table uprights where they bolt to the table and lightly bounce the tableoff the decck. All three bolt heads should hit the deck and the same time creating a single sound.

4.2.2.4. Positioning (Flagging) the Table

1. With the table a few inches off the pin deck, install 3 flags on the wing brackets at the 1, 7, and 10-pin positions of the table as shown in Figure 4.2-8.

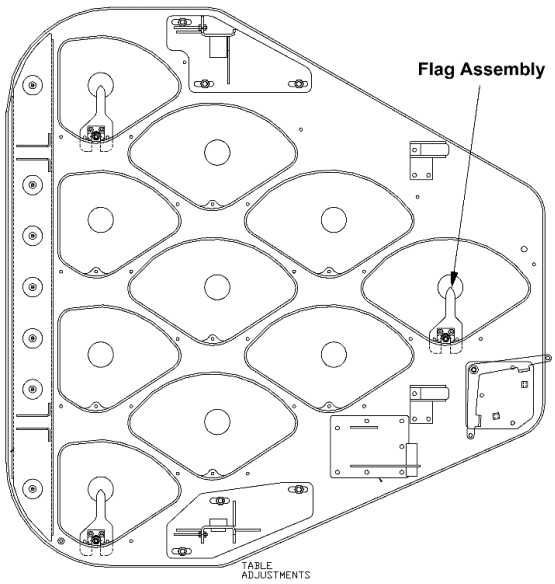

Figure 4.2-8

2. Remove the spot rod from the spot arm link.

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3. Remove the two tension springs from the 7-10 yoke shaft to the table uprights.

4. Lower the table to its lowest position and check its location relative to the pin spots. Because of the frame adjustment performed, the flags should align within ±1/8" side-to-side of the center of the pin spots, but may need front-to-back adjustment.

   If you ran out of side-to-side adjustment when installing the frame, additional side-to-side adjustment is made as detailed below.

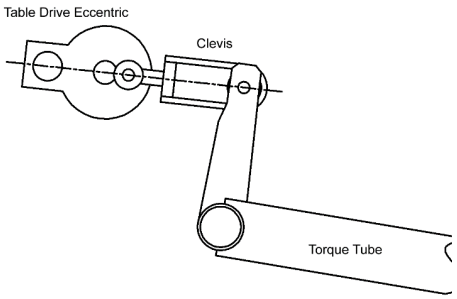

Figure 4.2-9a

5. If adjustment is necessary, proceed as follows:
   a. For side-to-side adjustment, loosen the bolts that attach the table support weldments to the torque tube arms, and transfer the appropriate number of C-washers from one support weldment to the other (see Figure 4.2-9b). Tighten the bolts.

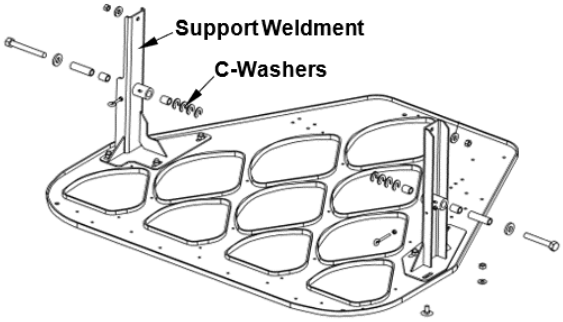

Figure 4.2-9b

Caution: Excessive side to side adjustment could result in interference. Check front end centering as discussed in Section 4 of the Installation Manual, P/N 400-088-128-xx.

   b. For front-to-back adjustment:
      1. Mark the table around the perimeter of the table support weldments where they attach to the table so that the amount and direction of movement can be seen.
      2. Loosen the 6 nuts on the carriage bolts that hold the table to the table uprights. The table uprights should be perpendicular to the pin deck.
      3. Move the table so that the points of the flags are exactly over the center of the 1, 7, and 10-pin spots.
      4. Tighten all six carriage bolt nuts.

6. Reattach the two tension springs to the 7-10 yoke shaft to the table uprights.

7. Reconnect the table spot rod.

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4.2.2.5. Spotting and Adjusting Pins

1. With the bin full of pins, hold down on the cam lever to manually actuate the spot linkage.
2. Use the hand crank (counter-clockwise) to lower the table to the point where the bottom of the pins (if not all, then most) first touch the pin deck.
3. Look for patterns that indicate the table is not level such as the 1, 2, & 3 pins or the 4, 7, & 8 pins being the only ones touching or not touching. Level the table as necessary.
4. For those pins not touching the pin deck, gently tap open the cup opening with a mallet so that the pin settles down a little further into the cup and just contacts the pin deck. (Figure 4.2-11).
5. For those pins already touching the pin deck, check how tightly they are being held in the cups. You should be able to move them without them feeling bound up, but not so much that you can move them forward and out of the cup without lifting them. Adjust the cup openings as needed.
6. Crank the table up (clockwise) slightly and then back down (counter-clockwise). All of the pins should touch the pin deck simultaneously. Stop the table with the pins just off the pin deck.
7. Loosen the jam nuts on the spot rod.
8. Adjust the spot rod so that the head of the table leg screw just begins to lift off of the table leg bracket. There should be a 1/16 to 3/32-inch gap [1.5 to 2.5 mm] (see Figure 4.2-10).

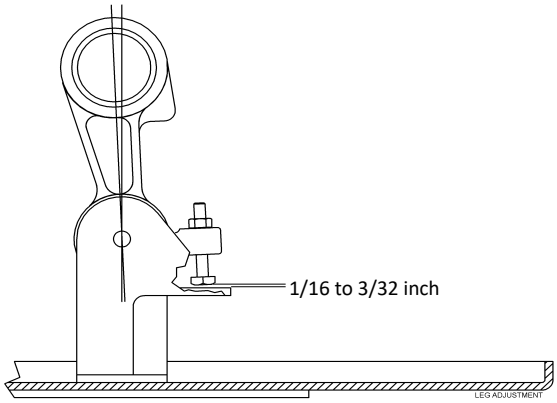

Figure 4.2-10

9. Gently push up and down on the front of the table to be sure this adjustment is true.
10. Once it is within adjustment, tighten the spot rod jam nuts.
11. Continue with the next adjustment.

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4.2.2.6. Individual Spotting Cup ON-SPOT Adjustments

1. With all 10 pins touching the pin deck, adjust the table height so that the pins cannot be pulled out of the front of the spotting cups and are held snugly in place (a slight amount of movement of some of the pins is okay). Ideally, all 10 pins will be touching the pin deck and will be snug in the spotting cups.

2. Adjust all 10 spotting cups to place the pins exactly on spot (±1/16”). To adjust the spotting cups in order to place pins on spot, proceed as follows:

   a. When pins are being set too far forward, loosen the two top cup nuts and tighten the bottom two nuts (see Figure 4.2-12).

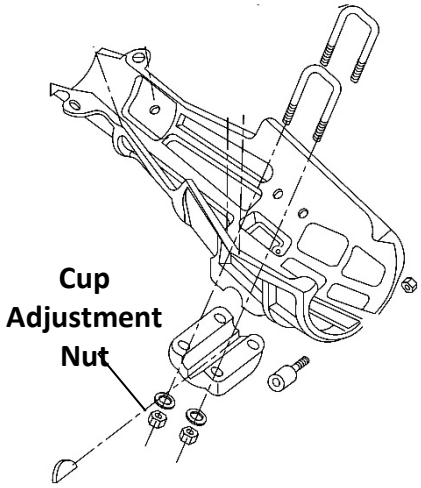

Figure 4.2-12

   b. When pins are being set too far back, loosen the bottom two nuts and tighten the top two nuts.

   c. When pins are being set too far left or right, loosen all four cup nuts and slide the cup on the shaft accordingly. Tighten the nuts.

When set correctly, the threads on the top two cup retaining bolts should be flush with or protrude only slightly from the nuts. The lower two nuts should have several threads protruding through them. Adjusting the cups can change that. If many of the cups need to be repositioned, it is likely that another adjustment is necessary and should be made instead.

4.2.2.7. Spotting Cup Toe-in

1. Run the table down so that the pins are just touching the pin deck but are still snug in the spotting cups.
2. Look under the table and note the gap between the heels (back) of all the pins and the pin deck. This gap should be roughly 1/8”.
3. If the gap is too large (greater than 3/16”), the Table must be moved rearward and Sections 4.2.2.5 through 4.2.2.7 must be repeated.
4. If the gap is too small (less than 1/16”) or there is no gap at all, the Table must be moved forward and sections 4.2.2.5 through 4.2.2.7 must be repeated.

4.2.2.8. Final Spot Checks

NOTE: Perform LOTO procedures before making any adjustments!

5. Run through a dozen or more spot cycles.

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6. Check that table motion is smooth with fluid cup rotation and no bounce. Loose torsion springs on the yoke assembly can cause jerky cup rotation. If the table has a bounce on its way down to the pin deck, or if the pins seem to hit the pin deck somewhat hard, be sure the torsion springs are adjusted so that the spring retaining clips are even with the top of the cup's u-bolt nuts. If the table still has a bounce, try wiping some lane oil on the spotting cup liners and see if the problem goes away. The last thing to check would be the 3/16" gap under the head of the table leg screw. Readjust if necessary.
7. Be sure that pins do not wobble or fall over when spotting. If pins wobble or fall over:
    a. Check that there are no broken or chipped bottom rings on the pins, and that there is no debris on the pin deck.
    b. Next, check the table height adjustment (5/16") and toe adjustment.
    c. If the height and toe measurements are correct, check the spot rod adjustment.
    d. If the spot rod adjustment is correct, remove one of the smaller counterbalance springs from the torque tube. If pins spot well now, the table will have to run for some time without this spring until the pivot points wear in some and loosen up.
8. Be sure that the table does not "deck" at Bottom Dead Center while spotting pins. This is easy to observe as the pins will touch the pin deck, and immediately after you will feel or hear the table hit the pin deck. If this happens, readjust the clevis. Keep in mind this may require you to make other adjustments as well.
9. Check the respot cells to be sure they open and close smoothly. If they don't, adjust the respot rod accordingly.
10. Once pins spot well, go back and check all jam nuts to be sure they are tight.
11. Press MODE button to place pinspotter into bowl/standby mode.

4.2.2.9. Table Off-Spot Switch Operation and Adjustment

When the table contacts an off-spot pin during a respot cycle, the table stops its downward movement, but clevis movement continues causing it to contact the off-spot lever actuating the off-spot switch. This action places the machine in a 2nd ball cycle, causes the table to return to the home position, and holds the sweep at the 1st guard position. As necessary, adjust the off-spot switch as follows:

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.

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8. With the table at the home position, loosen the off-spot adjusting screw jam nut located on the table arm just below the clevis (see Figure 4.2-13).

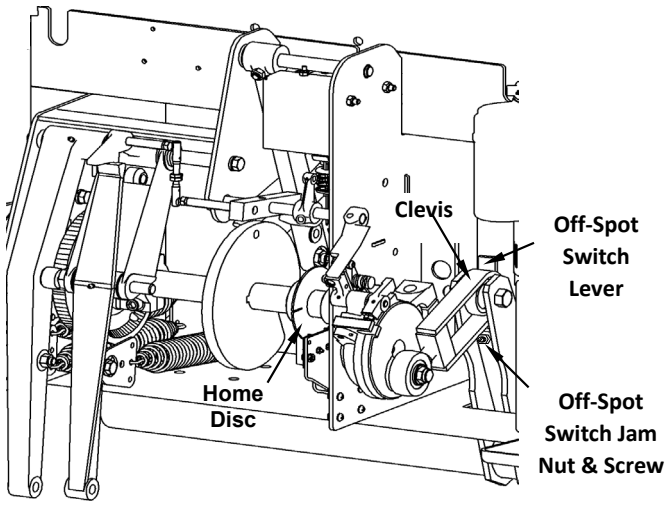

Figure 4.2-13

9. Using gauge 088-001-217, insert the thicker end of the gauge between the off-spot switch lever and the clevis at the point where the two meet. Adjust the screw counterclockwise to the point of switch actuation.
10. Remove the gauge. When the thinner end of the gauge is inserted (but not the taper at the end), the switch should not actuate.
11. Hold the screw in position and tighten the jam nut.
12. Remove lane barriers.
13. Remove LOTO.
14. Switch on breakers.
15. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
16. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
17. At the system controller, press the white E-stop RESET button.
18. Press TROUBLE CLEAR button.
19. Press MODE button to place pinspotter into bowl/standby mode.
20. Press EVEN/ODD button to move arrow to opposite pinspotter.
21. Press HOME button.

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22. Press CYCLE button.
23. To check above adjustment:
    a. Cycle the machine through the 1st ball cycle with a pin placed out of range.
    b. The sweep should drop to the 66° (1st guard) position.
    c. The table should contact the pin and return to the zero (home) position.
    d. The 2nd ball light should turn on.
6. Remove any fallen pins, open the respot cell fingers (perform LOTO), and press the SWEEP REVERSE button to bring the sweep to the home position and continue play.
7. Press MODE button to place pinspotter into bowl/standby mode.

CAUTION

Some of the table adjustments require that the table be operated under power. When this is the case, the respot cells should be actuated manually to open the fingers and prevent damage.

4.2.2.10. Table and Respot Cell Operation

Much of the table's operation is controlled by an encoder, pivot arms, control rods, a solenoid, latches, and levers. The table operating logic is as follows:

When the ball detector initiates a machine cycle, the state (energized or deenergized) of the solenoid determines whether the action results in setting a new set of pins, or in the respotting of the existing pin arrangement.

If the spotting solenoid is energized, the shuttle cam causes a set of pins to be deposited in the cups. The spot lever is captured at its top end causing the spot rod to pivot the cups as the table descends. At the same time, a lever actuates to cause the eccentric latch to disengage, allowing the table to descend fully to set the pins.

When a 1st ball cycle is initiated, the solenoid remains deenergized, and the eccentric remains latched causing the table to only partially descend. At the same time, the spot lever's pivot point changes to the center of the lever because it is not restrained at the top. This shortens its movement preventing the cups from pivoting. This also allows the respot rod to cause the respot cell fingers to close to pick up the pins that remain standing. The sweep cycles to remove the fallen pins (dead wood), and a shifter link pivots causing the fingers to open on the table's second visit to the respot position. The table and sweep then return to the home position.

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4.2.2.11. Table Home Position Adjustment

The Table drive shaft has a disc with a slot in it that provides feedback to the chassis via a sensor when the table drive shaft reaches the home position. This position should be just before the table reaches the highest point in its cycle (top dead center), at approximately the 355° point of drive shaft rotation. To adjust the table's home position:

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Disengage the brake (see Figure 4.2-14), and manually crank the table to just before top dead center. There should be a gap of approximately ½ inch between the table drive eccentric's white nylon roller and the rear edge of the cam link as viewed from above.
9. Loosen the setscrew in the collar that secures the home disc to the shaft, and rotate the disc until the light on the sensor comes on indicating that the slot in the disc is aligned with the sensor's optics. Tighten the setscrew.
10. Remove lane barriers.
11. Remove LOTO.
12. Switch on breakers.
13. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
14. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
15. At the system controller, press the white E-stop RESET button.
16. Press TROUBLE CLEAR button.
17. Press MODE button to place pinspotter into bowl/standby mode.
18. Press EVEN/ODD button to move arrow to opposite pinspotter.
19. Press HOME button.
20. Press CYCLE button. Run the table through several cycles, and verify it is stopping at the desired position.

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21. Press MODE button to place pinspotter into bowl/standby mode.

Because of the Table's inertia, it may stop slightly past the home position. This is normal. If the Table runs considerably past the home position and stops consistently at the same point, increase the gap between the nylon roller and cam link, and then reset the home disc at this new position. **Excessive coasting past the home position could indicate a motor brake problem.**

4.2.2.12. Table Drive Eccentric Operation

The table drive eccentric controls the low points of table travel during the spot and respot cycles. During a respot cycle, the eccentric's latch is engaged locking the eccentric's input and output sides together, which only allows the table to lower to the respot height. When the spotting solenoid is energized at the start of a spotting cycle, the eccentric's latch is disengaged allowing the two sides of the eccentric to operate independently. This permits the table to descend further for spotting a set of pins.

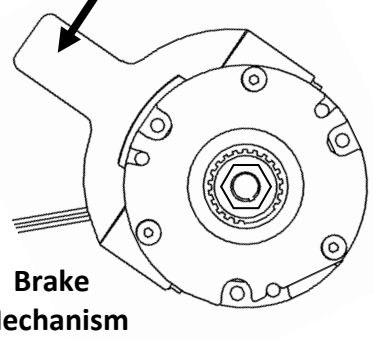

Figure 4.2-14

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4.2.2.13. Spotting Linkage Adjustments

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. With the table at the home position, the distance between the end of the shuttle stop lever assembly and the adjusting bolt (see Figure 4.2-15) should be .015 inches. Adjust the bolt to provide this spacing and then tighten the jam nut.

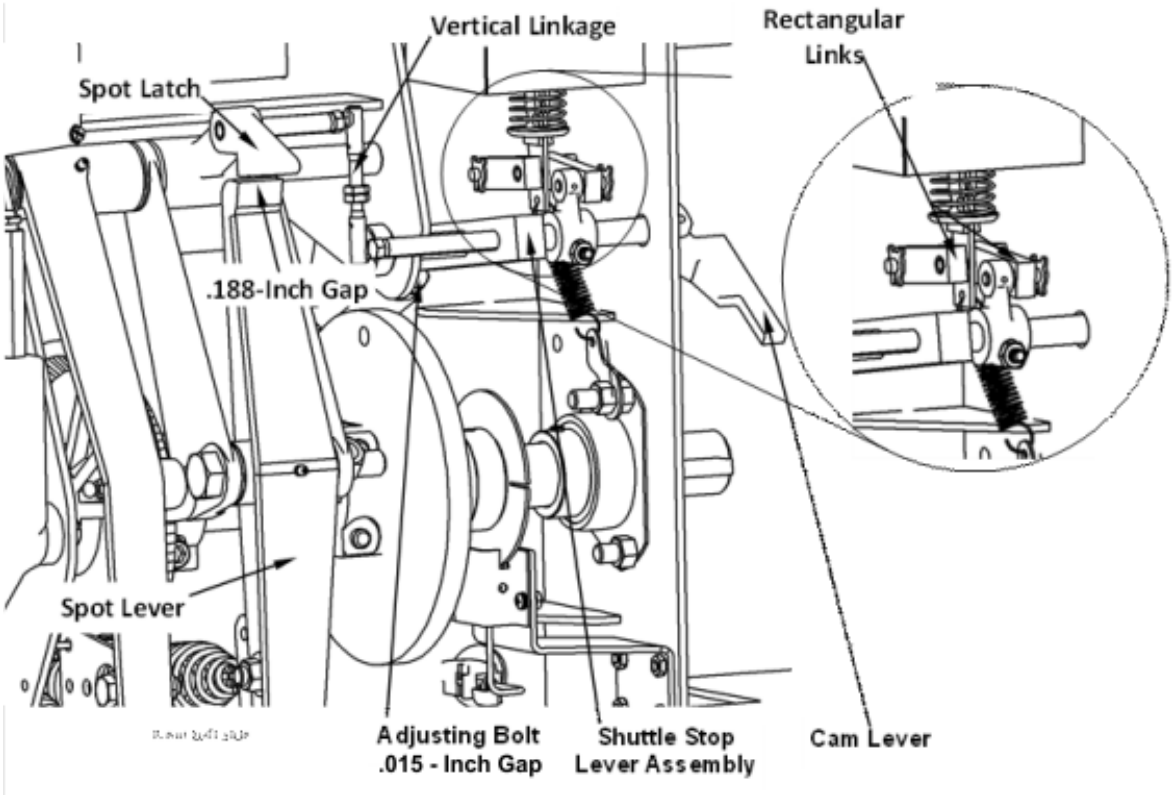

Figure 4.2-15

9. When the spotting solenoid is actuated, the cam lever should be locked in the down position. This locked condition is established when solenoid engagement causes the two rectangular links (see Figure 4.2-15) to align horizontally. Test for locking by manually engaging the

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solenoid and then pulling up on the cam lever. The lever must remain in the down position. This rigidity is necessary to disengage the eccentric's latching mechanism during a spotting cycle. If the lever moves, some part of the linkage is worn or broken and must be replaced.

10. With the table at the home position, insert the thicker end of gauge (088-001-217) between the top of the spot lever and the bottom edge of the spot latch. Adjust the vertical linkage to obtain a .188-inch clearance and then tighten the jam nuts against each other (Figure 4.2-15).
11. Remove lane barriers.
12. Remove LOTO.
13. Switch on breakers.
14. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
15. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
16. At the system controller, press the white E-stop RESET button.
17. Press TROUBLE CLEAR button.
18. Press MODE button to place pinspotter into bowl/standby mode.
19. Press EVEN/ODD button to move arrow to opposite pinspotter.
20. Press HOME button.
21. Press CYCLE button.
22. Press MODE button to place pinspotter into bowl/standby mode.

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4.2.2.14. Yoke Spring Adjustment

The yoke springs, located on the #3 and #4 yoke shafts, are used to stabilize cup movement during a spotting operation. They also serve to hold the spotting cups horizontal during a respot cycle.

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. With the table in the home position, loosen the spring retainer's locking nut slightly and tap the spring retainer on the yoke shaft so that the spring end is in line with the top of the nuts on the spotting cup cap (see Figure 4.2-16). This is the initial (approximate) setting.

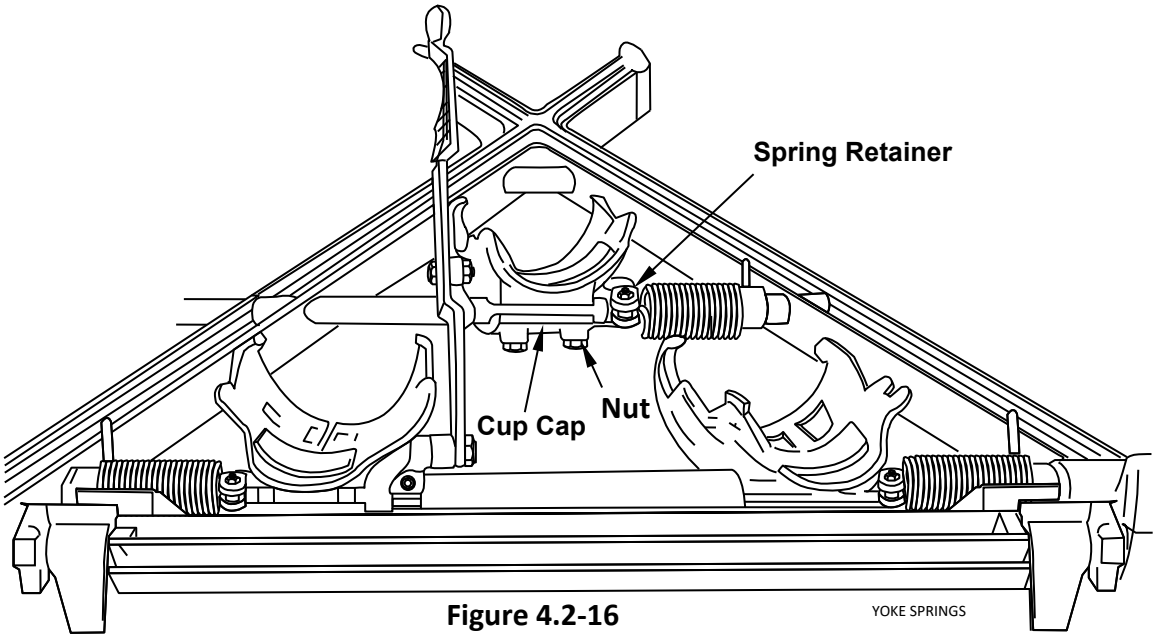

Figure 4.2-16

9. Remove lane barriers.
10. Remove LOTO.
11. Switch on breakers.

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12. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
13. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
14. At the system controller, press the white E-stop RESET button.
15. Press TROUBLE CLEAR button.
16. Press MODE button to place pinspotter into bowl/standby mode.
17. Press EVEN/ODD button to move arrow to opposite pinspotter.
18. Press HOME button.
19. Press CYCLE button.
20. Cycle the machine through several spotting operations and observe cup movement. Insufficient spring tension will cause unstable cup movement causing the pins to wobble or fall when spotted. Too much spring tension will cause the cups to slam back after the pins have been spotted. Adjust accordingly.
21. Press MODE button to place pinspotter into bowl/standby mode.

Note: If the springs need to be replaced, the yoke must be removed from the machine. See Section 4.2.2.16 for yoke assembly removal instructions.

4.2.2.15. Spot and Respot Lever Spring Removal or Replacement

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Hold the cam lever down on the table drive eccentric while holding the spot latch up (see Figure 4.2-17) and have a second person manually crank the table down.
    a. To remove the spot lever spring, stop the table when the lower end of the spot lever is in toward the table as far as it will go (minimum spring tension).
    b. To remove the two respot lever springs, stop the table when the lower end of the respot lever is in toward the table as far as it will go.

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9. Loosen the nut on the spring hanger bolt (see Figure 4.2-17) so that it is being held by just one or two threads.

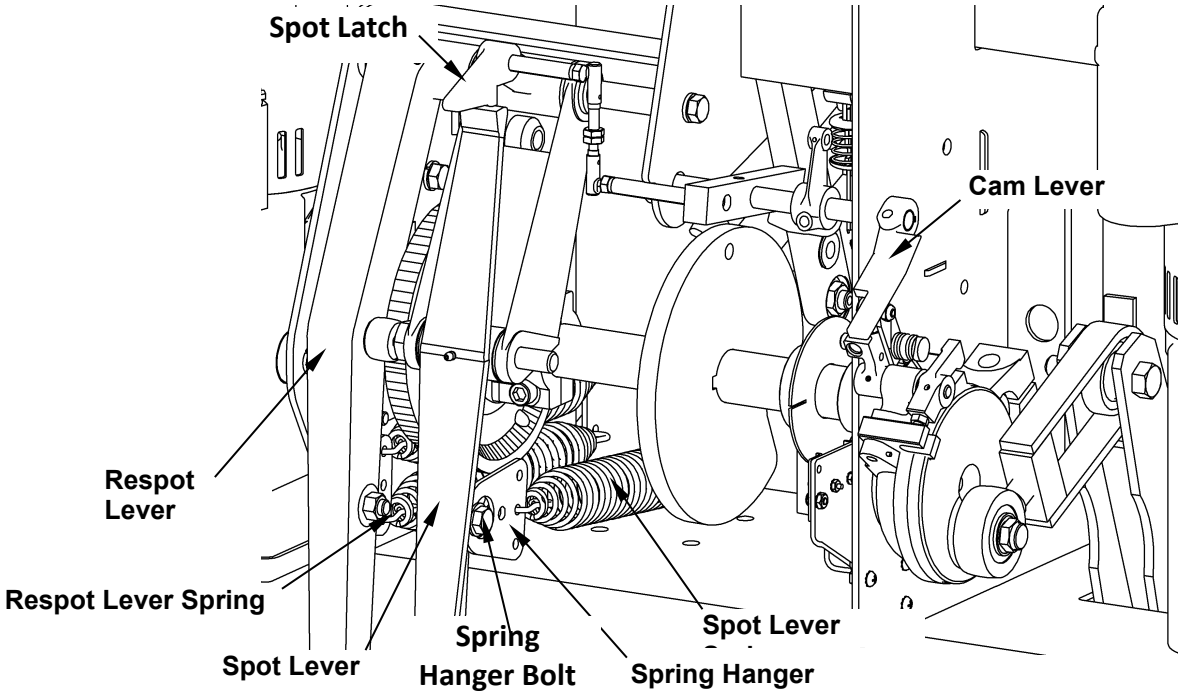

Figure 4.2-17

10. Insert the spring puller (792-505-005) in the center hole in the spring hanger. Free the hanger from the bolt by pulling on the hanger and passing the larger part of the slotted opening in the spring hanger over the bolt head.
11. Complete the removal of the hanger bolt and nut. Inspect the hanger and bolt, and replace if needed.
12. To replace spring(s), reverse the actions in steps 9 through 11 above.
13. Crank the table to the home position.
14. Remove lane barriers.
15. Remove LOTO.
16. Switch on breakers.
17. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
18. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
19. At the system controller, press the white E-stop RESET button.
20. Press TROUBLE CLEAR button.

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21. Press MODE button to place pinspotter into bowl/standby mode.
22. Press EVEN/ODD button to move arrow to opposite pinspotter.
23. Press HOME button.
24. Press CYCLE button.
25. Press MODE button to place pinspotter into bowl/standby mode.

4.2.2.16. Yoke Assembly (X-Frame) Removal

Note: If the yoke is broken, it can be repaired with Yoke Repair Kit #610-704-011. It is not necessary to remove the yoke from the table in order to make the repair.

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. With the table at the home position, disconnect the spot and respot rods from the lower end of the spot and respot levers.
9. Hold the cam lever down on the table drive eccentric and manually crank the table to the 180 degree position, which is the lowest position of the table.
10. Remove the pins from the spotting cups.
11. Disconnect the extension springs (one on each side) which attach yoke shaft #4 to the table uprights. (See Figure 4.2-18.)

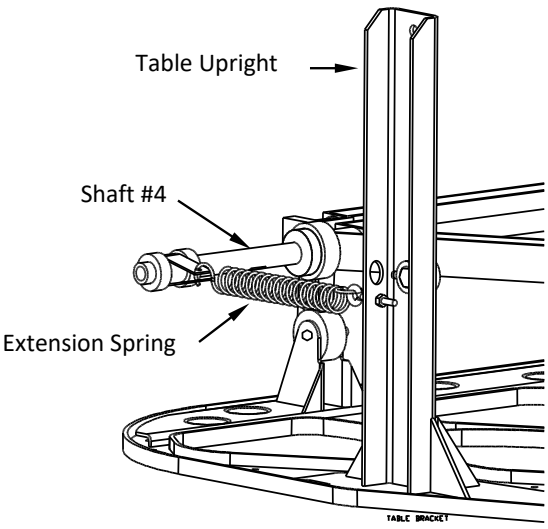

Figure 4.2-18

12. Remove the bolts that attach the front and rear X-frame legs to the front and rear table brackets. The yoke can now be removed.
13. To reinstall the yoke assembly, reverse the actions of steps 8, 9, 11, & 12.
14. Remove lane barriers.

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15. Remove LOTO.
16. Switch on breakers.
17. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
18. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
19. At the system controller, press the white E-stop RESET button.
20. Press TROUBLE CLEAR button.
21. Press MODE button to place pinspotter into bowl/standby mode.
22. Press EVEN/ODD button to move arrow to opposite pinspotter.
23. Press HOME button.
24. Press CYCLE button.
25. Press MODE button to place pinspotter into bowl/standby mode.

4.2.2.17. Respot Cell Operation & Adjustments

When the table lowers to pick up pins as in a first ball cycle, the respot cell fingers close on the standing pins, lock, and then the table raises the pins high enough for the sweep to clear the lane of fallen pins. The table then respots the pins.

4.2.2.17.1 Finger Adjustment

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.

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8. Move the respot cell linkage to close the cell fingers.
9. Using a 1/8-inch hex wrench and the widest part of the respot cell gauge (070-006-519), adjust each of the respot cells for a 2-inch opening between fingers approximately mid way along the fingers (see Figure 4.2-19). This adjustment can be made with the respot cell either in or out of the table.
10. Remove lane barriers.
11. Remove LOTO.
12. Switch on breakers.
13. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.

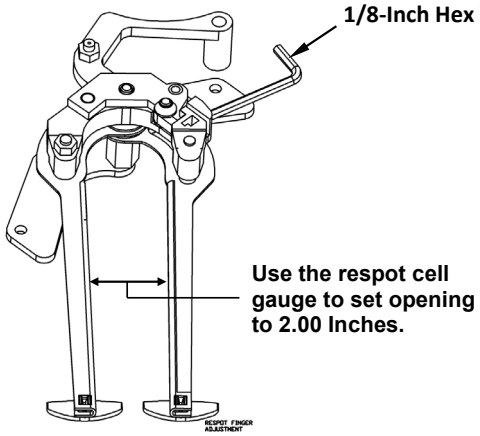

Figure 4.2-19

14. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
15. At the system controller, press the white E-stop RESET button.
16. Press TROUBLE CLEAR button.
17. Press MODE button to place pinspotter into bowl/standby mode.
18. Press EVEN/ODD button to move arrow to opposite pinspotter.
19. Press HOME button.
20. Press CYCLE button.
21. Press MODE button to place pinspotter into bowl/standby mode.

4.2.2.17.2 Respot Cell Adjustment

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).

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7. Deploy lane barriers.
8. Manually crank the table to the spotting position.
9. Disconnect the 6 body links that connect the respot cells to the #7, #8 & #9 connecting links (see Figure 4.2-20).
10. Loosen the bolts that connect cells #8, #9 & #10 to the slotted ends of the connecting links. **Do <u>not</u> loosen the bolt at the #7 cell connecting link.**

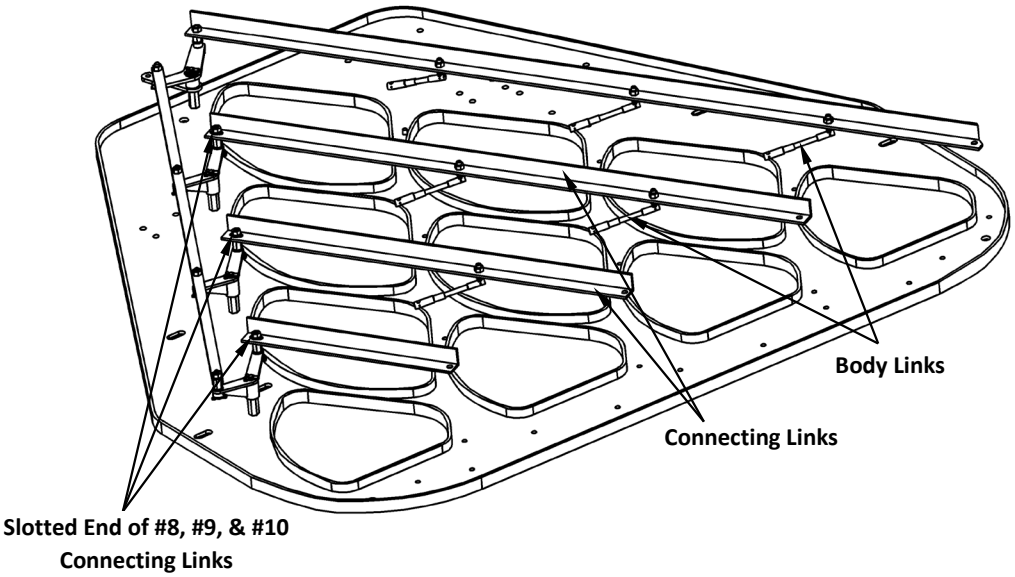

Figure 4.2-20

11. Loosen the two actuator stop screw nuts, and back the actuator stop screws away from the tabs on the front actuator lever (see Figure 4.2-21).
12. Set the length of the long rod on the front actuator assembly to 8-1/8 inches (206 mm) from center to center between the openings at each end.
13. Open cell #7 fully. If necessary, adjust (shorten) the length of the short rod (figure 4.2-21) to allow the fingers of cell #7 to open fully. Ensure the front actuator isn't contacting the open position stop screw

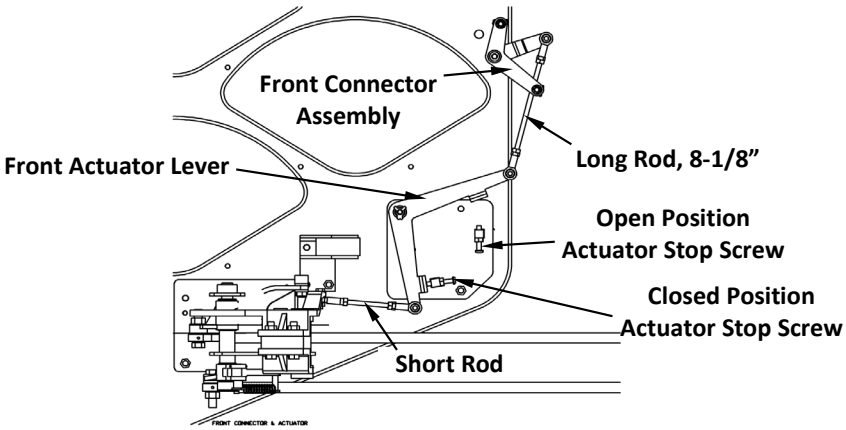

Figure 4.2-21

14. While keeping cell #7 fingers fully open against their stops, adjust the slot in the #8 cell connecting link so that the #8 cell is fully open. Keeping the #8 cell fully open, tighten the bolt in the #8 connecting link slot.
15. Repeat Step 14 for the #9 and #10 cells.
16. With the rear cells (#7, #8, #9, & #10) fully open, turn the open position actuator stop screw until it is against the actuator lever. Lengthen the short rod until there is 1/8" [3 mm] gap

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between the cam follower and cam link (figure 4.2-22) and then turn the screw an additional 1/2 turn. Tighten the jam nut on the stop screw.

17. With all cells fully open, adjust and connect the respot cell body links for the remaining 6 cells so that when connected, the cells are fully open. Set the length of the body links so that the excess movement (play) in cells 1 through 6 matches the excess movement in cells 7 through 10.

NOTE: When all of the respot cells have been adjusted, and with the front actuator lever in the open position against the stop, there should be approximately 1/4-inch of play in each cell's fingers.

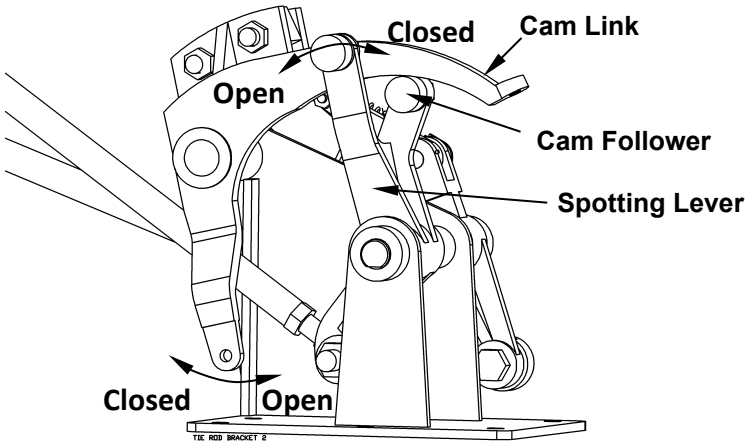

Figure 4.2-22

18. Open the respot cells fully (actuator lever against the open position stop screw).

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19. With the spotting lever in the fingers open position, adjust the length of the short rod (Figure 4.2-21) so that the cam link (Figure 4.2-22) just makes contact with the cam follower. THE CAM FOLLOWER MUST STILL BE ABLE TO TURN FREELY. Tighten the jam nuts on the short rod.
20. Recheck the adjustment of the long rod, and adjust as necessary to ensure that all cells are fully open and have the correct amount of play in the respot cell fingers.
21. Crank the table to the home position.
22. With the pin deck clear, crank the table down to the respot position.
23. Rotate the front actuator lever to close the cells completely. Adjust the closed position actuator stop screw until it is against the actuator lever. Turn the screw an additional 2 turns. There should be approximately 1/8" [3 mm] between the cam studs and the end of the slot on each finger (see Figure 4.2-23). Turning the stop screw in increases the gap. Tighten the jam nut on the closed position stop screw.

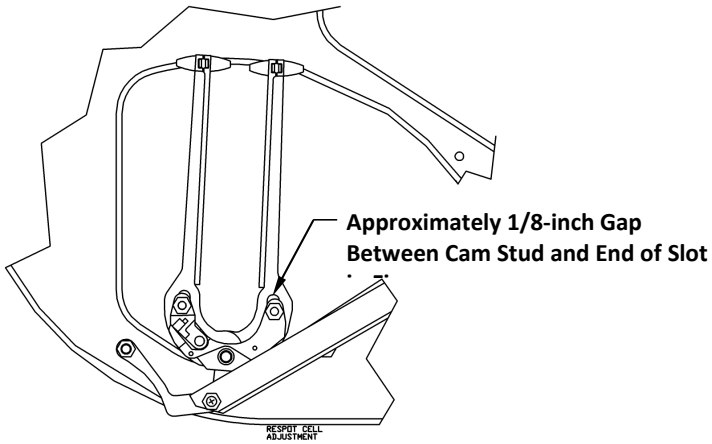

Figure 4.2-23

Crank the table to the home position.

24. Close the respot cells slightly so that the center highest point of the shifter link is directly opposite the pawl (see Figure 4.2-24). Adjust the length of the respot rod so that the pawl clears the center highest point by 3/8" [9.5 mm].
25. Remove lane barriers.
26. Remove LOTO.
27. Switch on breakers.
28. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
29. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
30. At the system controller, press the white E-stop RESET button.

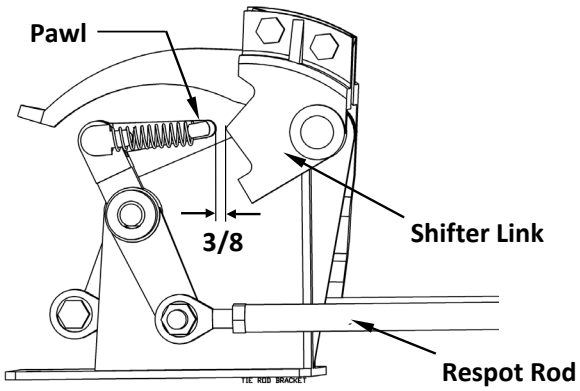

Figure 4.2-24

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31. Press TROUBLE CLEAR button.
32. Press MODE button to place pinspotter into bowl/standby mode.
33. Press EVEN/ODD button to move arrow to opposite pinspotter.
34. Press HOME button.
35. Press CYCLE button.
36. Run the table though a respot cycle. The cell fingers should open and close at the lowest point of the stroke. If the fingers appear to open and close too early, shorten the respot rod to increase the clearance between the pawl and shifter link. If the fingers appear to open and close too late, lengthen the respot rod accordingly.
37. Press MODE button to place pinspotter into bowl/standby mode.

Note: When the fingers are adjusted properly, all of the pins should be held at the same point (near the top ring) on the neck. This will cause all of the pins to contact the pin deck at the same time minimizing respotting problems. If one or more pins are not being picked up in this manner, readjust those cells in accordance with Section 4.2.2.17.1.

4.2.2.18. Table Motor and Gearbox Removal

For table drive motor and gearbox removal, refer to the *EDGE Free Fall Motor & Gearbox Manual*, P/N 400-088-038-xx.

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4.2.3. Sweep Operation and Adjustments

Sweep operation is controlled by the system controller and utilizes an encoder as well as a home disc to determine its position. The sweep's motion is broken down into degrees (0 to 360) so that settings can be entered into the system controller. Since the sweep contains a number of linkages, the exact angle for a given stopping point (1st guard, 2nd guard, etc.) can vary slightly from machine to machine and should be determined during the initial setup. The sweep drive motor contains an electric brake that keeps the unit from coasting through its stopping position. The brake can be disengaged for manual cranking.

One feature of having the system controller control the sweep is that if the sweep stops out of position, the system controller will sense this and automatically correct the stopping position within a few cycles. It does this by sensing whether the sweep stopped before or after its setpoint, and either turns the motor off a few degrees sooner or later, as needed, to have the sweep come to a stop at the correct point.

4.2.3.1. Sweep Adjustments

Note: Sweep adjustments should be made on both sides of the machine.

Note: Sweep travel is determined by the length of the short connecting rod. If this rod is too long, the sweep will collapse into the pit. If too short, the sweep will hit the frame of the machine at the home position.

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.

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4.2.3.2. Sweep Height at 1st Guard

8. Loosen the jam nuts (6) on the sweep connecting rods (the two long ones and the short one connected to the crank arm).
9. Adjust the long connecting rods so that a total of ten threads for both end rods combined (i.e., 5/5, 6/4, 7/3, etc.) are showing on the 10-pin side and 10 to 12 threads total are showing on the 7-pin side.
10. Manually crank the sweep to the 1st guard position. At 1st guard the sweep bar should be as far down and as far forward as it will go. Also the sweep link should be resting on the rubber bumper, and the sweep link slide assembly's bumper should be against the stop (see Figure 4.2-25).
11. Place the large end of the sweep frame gauge, (088-001-216) under each end of the sweep baron the lane.
12. Loosen the nut in the slot on the sweep link bracket (Figure 4.2-25) and slide the rod end forward to remove all the play in the linkage and then tighten the nut. Repeat for the other side of the sweep.

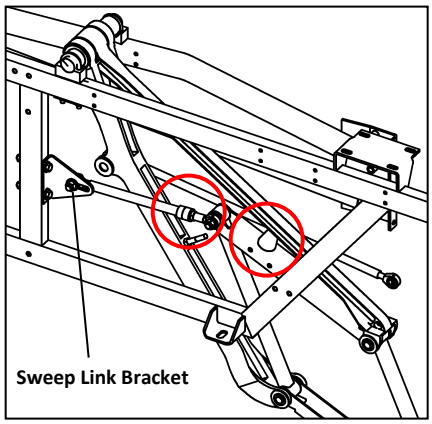

Figure 4.2-25

4.2.3.3. Sweep Height at the 4, 5 and 6 Spots and Stroke Length

13. Crank the sweep to the center of the 4, 5, & 6 row of spots.
14. Adjust the sweep's height to 3/16 ±1/16 inch (3-6 mm) **above the lane** (check using the sweep frame gauge, 088-001-216). Make the adjustment by loosening the two screws that secure the sweep link bracket to the pinspotter frame and adjusting the bracket up or down as needed. Upward movement lowers the sweep and downward movement raises the sweep. Make this adjustment on both sides of the sweep.
15. Crank the sweep to the 7-10 line.
16. Adjust the sweep so that it is square to the lane by adjusting the long rods.

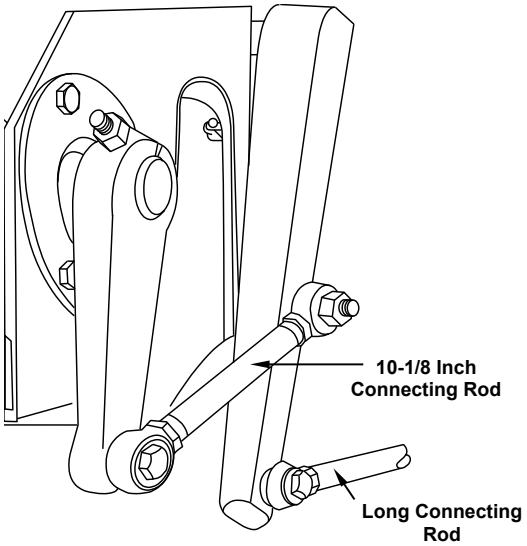

Figure 4.2-25

17. Crank the sweep to its maximum rearward travel. The front of the sweep bar should be even with the back of the 7 and 10

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spots. The sweep will extend farther back when it is under power. Adjust by changing the length of the short sweep connecting rod.

18. Crank the sweep to its home position.
19. Remove lane barriers.
20. Remove LOTO.
21. Switch on breakers.
22. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
23. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane hand rail. The green LED indicator should light.
24. At the system controller, press the white E-stop reset button.
25. Press TROUBLE CLEAR button.
26. Press MODE button to place pinspotter into bowl/standby mode.
27. Run the pinspotter under power. If the sweep captures a pin by its head at the rear of travel, it is set too far back. Adjust as necessary.
28. Tighten the six jam nuts on the three sweep connecting rods.
29. Press EVEN/ODD button to move arrow to opposite pinspotter.
30. Press HOME button.
31. Press MODE button to place pinspotter into bowl/standby mode.

4.2.3.4. Sweep Home Position Adjustment

The Sweep drive shaft has a disc with a slot in it that provides feedback to the system controller via a sensor when the drive shaft reaches the Home position. The Sweep's Home position should be at the highest point in its cycle.

1. Press the MODE button to place pinspotter into mechanic mode.
2. Cycle the pinspotter one complete cycle.
3. Implement Lockout/Tagout (LOTO).
4. Deploy lane barriers.
5. Disengage the brake (see figure 4.2-29) and crank the sweep motor until the home disc indicating LED is on.
6. Observe the location of the sweep motor tie rod assembly in relation to the crank arm and drive shaft. The tie rod assembly should bisect the crank arm and drive shaft. If this is not the case, crank the sweep motor until the tie rod bisects the crank arm and drive shaft.
7. Loosen the setscrew holding the home encoder disc to the sweep drive shaft.
8. Rotate the home encoder disc on the drive shaft until the home sensor LED comes on.
9. Hold the home encoder disc so it is centered in the slot of the sensor guard, and tighten the setscrew securely to the drive shaft.

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10. Remove lane barriers.
11. Remove LOTO.
12. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
13. Press the blue RESET button located on the e-stop/reset button box, located on the even lane hand rail. The green LED indicator should light.
14. At the system controller, press the white E-stop RESET button.
15. Press TROUBLE CLEAR button.
16. System controller guard setting will need to be adjusted if home encoder disc location was moved.
17. Place pinspotter into mechanic mode.
18. Cycle pinspotter and check for correct operation.
19. Place pinspotter into standby mode.

NOTE: A slight amount of overtravel is normal. If the Sweep runs considerably past the Home position and consistently stops at the same point, reset the home disc with the Sweep at a slightly lower position. **Excessive coasting of the Sweep past the Home position could indicate a motor brake problem. You can observe the operation of the brake by watching the motor shaft and hexagonal hub in the center of the brake. The shaft should stop abruptly when the motor turns off.**

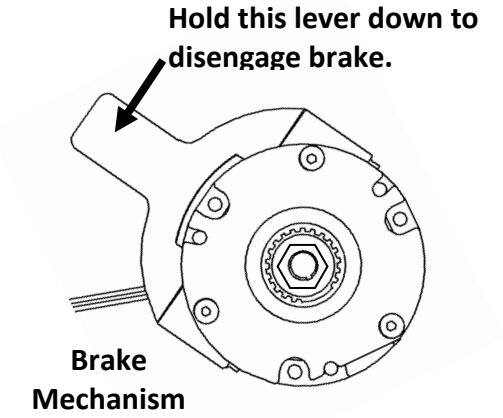

Figure 4.2-29

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4.2.3.5. 1st and 2nd Guard Positions

When the ball detector senses the passage of a ball, the system conntroller directs the sweep to descend to the 1st guard position so that no further play can take place while the pins complete their action and are scored. Following removal of the deadwood, the sweep stops at the 2nd Guard position while pins are spotted or respotted. At both the 1st and 2nd guard positions, the sweep should be positioned slightly above the surface of the lane. These positions are indicated on the system controller display in degrees of drive shaft rotation (000 to 360). The 1st guard position should be approximately 70° and the 2nd guard position should be approximately 270°.

Because of slight variations between lanes and pinspotter adjustments, it may be necessary to fine tune the position of the Sweep at the 1st and 2nd Guard positions. This is done by changing the setpoints in the *Guard Set Menu* on the system controller. Refer to the EDGE Free Fall System Controller Manual (400-088-009-03) for specifics on changing system controller setpoints**. Following a setpoint change, cycle the pinspotter several times until it is stopping consistently in the same place before making further adjustment.**

4.2.3.6. Sweep Motor and Gearbox Removal

For sweep drive motor and gearbox removal, refer to the *EDGE Free Fall Motor & Gearbox Manual*, P/N 400-088-038-xx.

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4.2.4. **Positive Ball Lift**

The purpose of the Positive Ball Lift (PBL) is to raise the ball high enough to permit a gravity return to the bowler. The ball lift consists of a number of separate assemblies that work together to achieve the desired result. For complete information about the Positive Ball Lift refer to the *Positive Ball Lift Manual,* 400-088-011-xx.

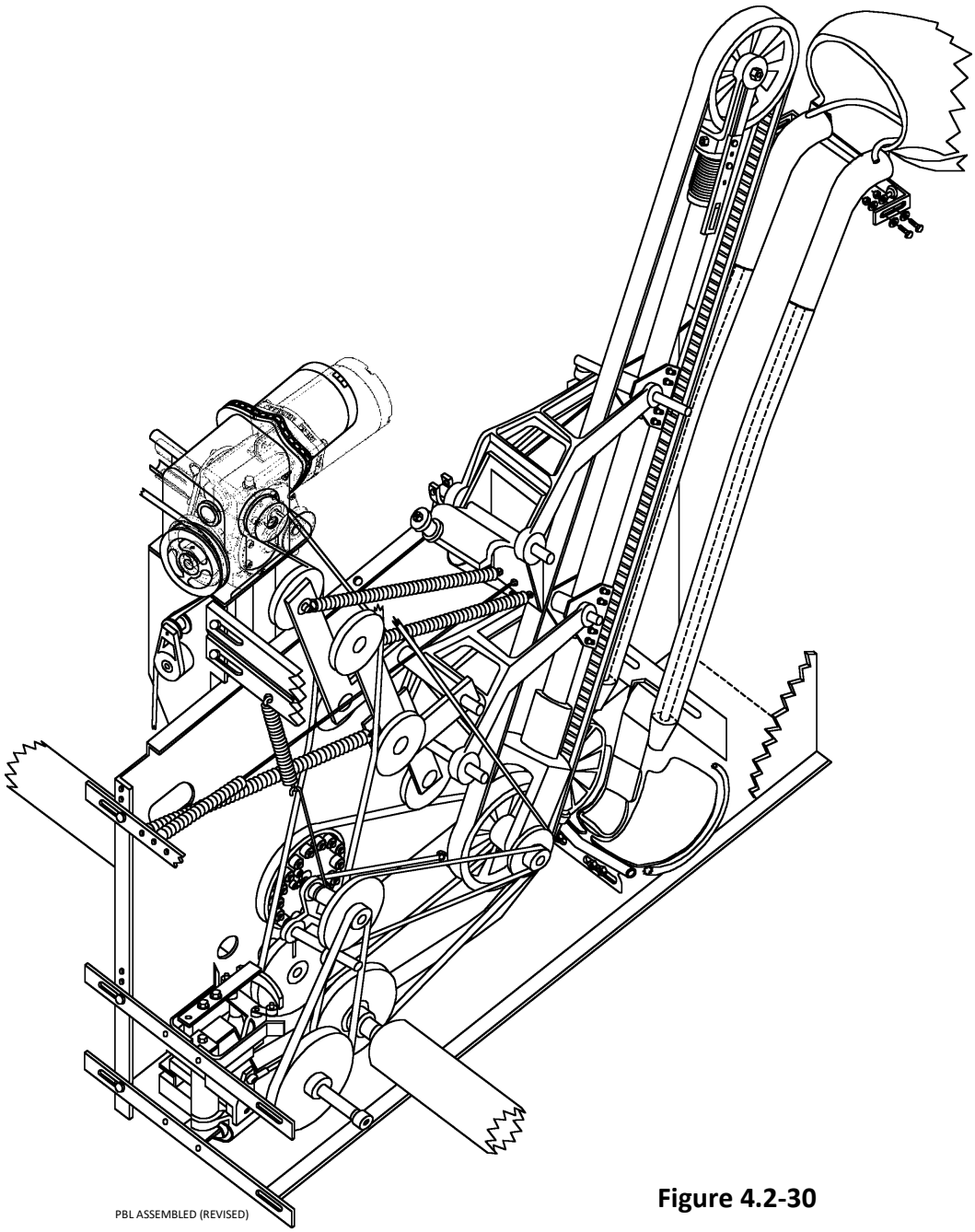

Figure 4.2-30

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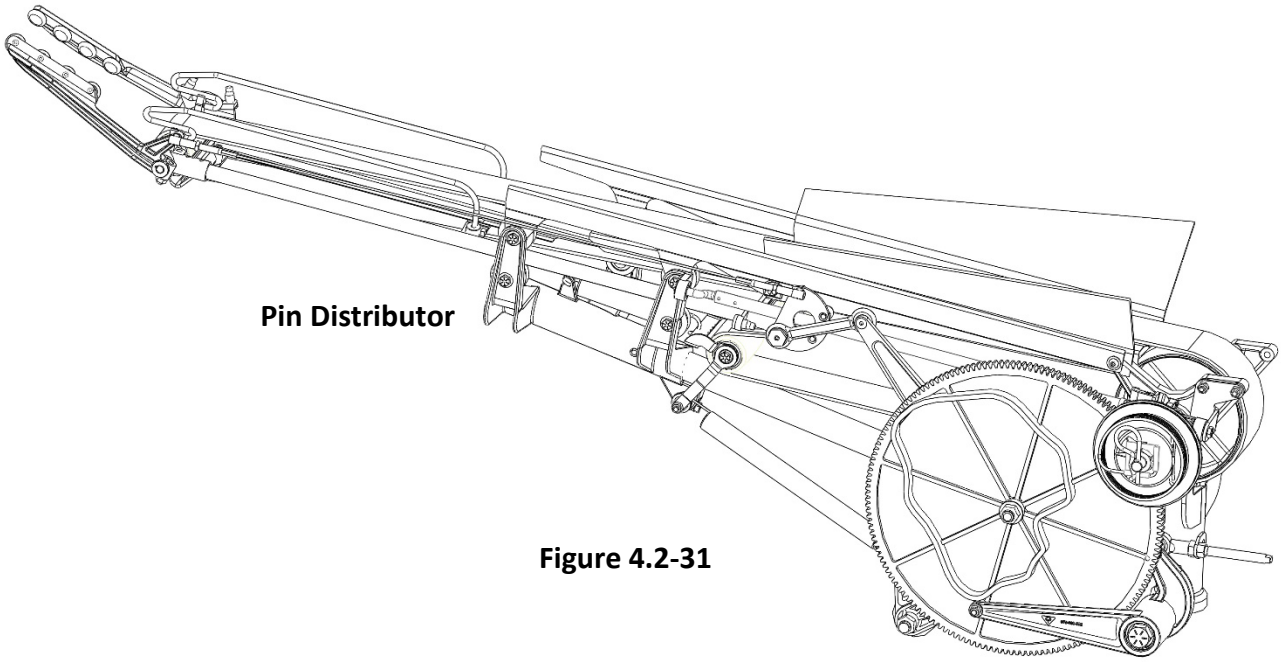
4.2.5. **Distributor**

The Distributor transfers pins from the EDGE Lift to the Durabin. Through a number of cleverly designed components, it extends and retracts while sweeping from side to side stopping and depositing pins in each of the ten bin positions. For complete information concerning the Distributor, refer to the *EDGE Free Fall Distributor Manual*, 400-088-121-xx.



Pin Distributor

Figure 4.2-31

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4.2.6. Durabin and Shuttle Operation & Adjustment

4.2.6.1. Durabin and Shuttle Operation

The Durabin assembly can store two complete sets of pins. The shuttle, located below the Durabin, holds the pins in the Durabin until a new setup is required. When the shuttle cam follower, which is attached to the shuttle, travels into the low point of the shuttle cam, located on the table drive shaft, the shuttle momentarily moves forward allowing a set of pins to drop through from the Durabin to the spotting cups.

4.2.6.2. Durabin and Shuttle Adjustments

Note: Adjustments must be made with no pins in the bin.

1. With Durabin with Optical Bin Switch, there should be approximately 2 1/2" between the back edge of the Durabins back channel and the leading edge of the shuttle assembly measured at the center of the Durabin (see Figure 4.2-32). Make adjustments if shuttle malfunctions are occurring, i.e. double shuttling or a pin is not shuttling. Adjustment procedure - For double shuttling: Lengthen shuttle rod until one pin does not shuttle, then shorten shuttle rod by 1 to 2 turns of the rod end. For a pin not shuttling, shorten the shuttle rod by 1 to 2 turns of the rod end. To adjust,
   a. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
   b. Place pinspotter in mechanic mode by pressing MODE button.
   c. Press EVEN/ODD button so arrow is pointing to other lane.
   d. Press MODE button to put lane into mechanic mode.
   e. Switch off breakers.
   f. Implement Lockout/Tagout (LOTO).
   g. Deploy lane barriers.
   h. Remove shuttle spring.
   i. Place a punch or screwdriver through the hole near the shuttle end of the shuttle connecting rod's tube, and then loosen the jam nut on the end fitting. Do not rotate the connecting rod's tube, as this will loosen the connecting rod's components causing the shuttle to malfunction during operation.
   j. Disconnect the end of the shuttle connecting rod from the shuttle and adjust the length of the rod accordingly.
   k. Reconnect the rod and tighten the jam nut.
   l. Remove lane barriers.
   m. Remove LOTO.
   n. Switch on breakers.

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o. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
p. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane hand rail. The green LED indicator should light.
q. At the system controller, press the white E-stop RESET button.

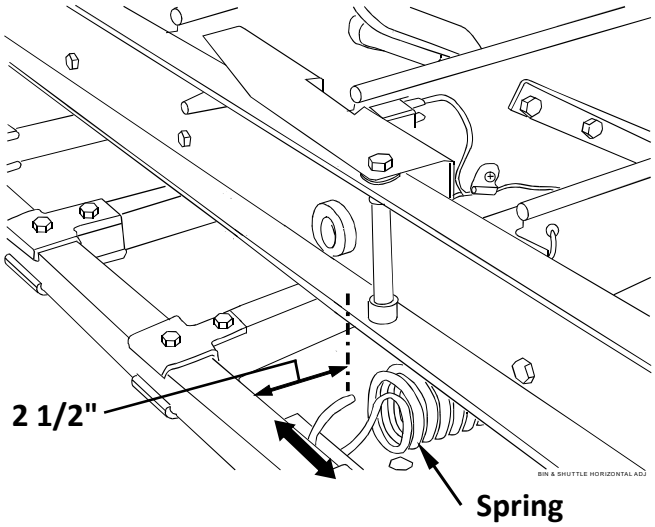

Figure 4.2-32

r. Press TROUBLE CLEAR button.
s. Press MODE button to place pinspotter into bowl/standby mode.
t. Press EVEN/ODD button to move arrow to opposite pinspotter.
u. Press HOME button.
v. Press CYCLE button.
w. Press MODE button to place pinspotter into bowl/standby mode.

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4.2.6.3. Bin Switch Operation

The optical bin switch (BSO) is located behind the #9 pin location on the Durabin. The #9 bin position is the last one filled when preparing the bin for a new set of pins. When the 10th pin is delivered to the #9 bin position, it is detected by optical sensor which actuates the bin switch (see Figure 4.2-33a), and sends a signal to the system controller indicating that 10 pins are ready for a spotting cycle.

Test the switch with a pin several times. If the switch does not actuate, verify that the lens is clean, the opening in the bin pocket is clear of debris, the mounting screws are tight, and that the connector is securely connected.

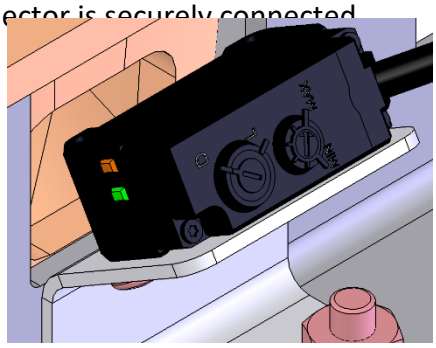

Figure 4.2-33a

Figure 4.2-33b

4.2.6.4. Optical Bin Switch Adjustment

The bin switch is set and tested before the pinspotter is shipped, but should adjustment be necessary, such as when installing a replacement bin switch, perform the following.

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Place a bowling pin in the 9-Pin bin pocket, standing up vertically on the Spotting Cup. (See Figure 4.2-33b)
9. Using a small flat-blade screwdriver, set the larger dial on the back of the Optical Sensor, Labeled D-L, to “D”. Adjust the smaller (intensity) dial to MAX (fully clockwise). While

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watching the Orange and Green LEDs on the side of the Sensor (refer to Figure 4.2-33a), turn the intensity dial counterclockwise slowly through the following sequence:

a. Green LED is on, (Orange LED is off)

b. Green LED goes out (both LEDs are off)

c. Orange LED turns on

d. Green LED turns on (both LEDs are on)

Stop at the point where the Green LED turns back on and both LEDs are on (Step D). The proper intensity is now set.

10. Remove lane barriers.
11. Remove LOTO.
12. Switch on breakers.
13. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
14. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane hand rail. The green LED indicator should light.
15. At the system controller, press the white E-stop reset button.
16. Press TROUBLE CLEAR button.
17. Press MODE button to place pinspotter into bowl/standby mode.
18. Press EVEN/ODD button to move arrow to opposite pinspotter.
19. Press HOME button.
20. Test the pinspotter for proper operation. If the bin switch signal works opposite of what it should, switch the D-L setting on the sensor.
21. Press MODE button to place pinspotter into bowl/standby mode.

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4.2.7. Cushion Operation and Adjustments

4.2.7.1. Cushion Shock Absorber Adjustment

Note: This adjustment can be made either with the shock absorber mounted in the machine or held in a vise.

CAUTION

If the shock absorber is held in a vise, clamp the shock on its end only. DO NOT PLACE THE PISTON SECTION IN A VISE.

1. At system controller, select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Loosen the collar's lock screw.

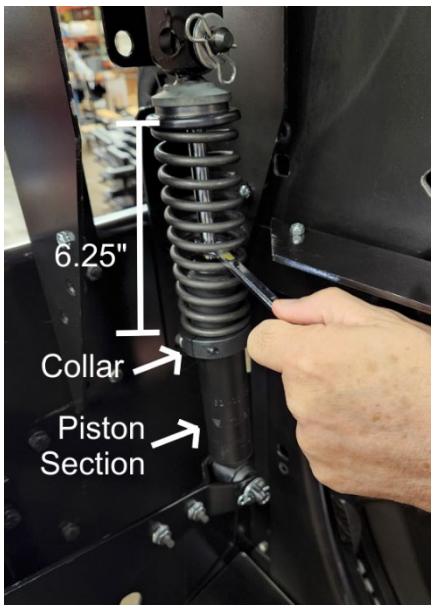

Figure 4.2-34

9. Insert a 1/2-inch open-end wrench between the coils of the spring at the point where the piston rod exits the piston housing so that the open end of the wrench straddles the piston rod.
10. Hold the wrench against the piston housing while turning the spring. When the length of the spring is 6¼ inches, slide the collar against the spring, tighten the collar's lock screw, and remove the wrench.
11. Remove lane barriers.
12. Remove LOTO.
13. Switch on breakers.
14. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
15. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane hand rail. The green LED indicator should light.
16. At the system controller, press the white E-stop reset button.

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17. Press TROUBLE CLEAR button.
18. Press MODE button to place pinspotter into bowl/standby mode.
19. Press EVEN/ODD button to move arrow to opposite pinspotter.
20. Press HOME button.
21. Press CYCLE button.
22. Press MODE button to place pinspotter into bowl/standby mode.

4.2.7.2. Cushion Removal

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Unlatch the pin curtain.
9. Remove the clevis pin from the lower shock absorber mounting pin and remove the pin to release the shock absorber from the cushion assembly.
10. Remove the three bolts and lock washers that mount the support box to the kickback plate (See Figure 4.2-35) ***on the shock absorber end of the cushion only***!
11. Slide the free end of the cushion forward until the other end comes free from its mount block. Remove the cushion assembly from the machine.
12. To replace, reverse the above procedure.
13. Remove lane barriers.
14. Remove LOTO.
15. Switch on breakers.
16. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
17. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane hand rail. The green LED indicator should light.
18. At the system controller, press the white E-stop RESET button.

Figure 4.2-35

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19. Press TROUBLE CLEAR button.
20. Press MODE button to place pinspotter into bowl/standby mode.
21. Press EVEN/ODD button to move arrow to opposite pinspotter.
22. Press HOME button.
23. Press CYCLE button.
24. Press MODE button to place pinspotter into bowl/standby mode.

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4.2.7.3. Replacing Urethane Rivets

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Remove any remaining sections of the broken rivet.
9. Lubricate the raised portion of the new rivet's stem with liquid soap.
10. Push the rivet through the cushion assembly until about 1 inch protrudes through the back of the wooden plank.
11. Insert the end of the urethane rivet protruding through the wooden plank into the hole near the end of the belt installation tool (784-003-000).
12. Use the tool as a crank to pull on the rivet until the raised portion of the stem is pulled through the back of the wooden plank. Trim the ends of the rivets along the bottom row as necessary to prevent them from interfering with the passage of fallen pins.
13. Remove lane barriers.
14. Remove LOTO.
15. Switch on breakers.
16. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
17. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane hand rail. The green LED indicator should light.
18. At the system controller, press the white E-stop RESET button.
19. Press TROUBLE CLEAR button.
20. Press MODE button to place pinspotter into bowl/standby mode.
21. Press EVEN/ODD button to move arrow to opposite pinspotter.
22. Press HOME button.
23. Press CYCLE button.
24. Press MODE button to place pinspotter into bowl/standby mode.

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4.2.7.4. Replacing Cushion Components

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Remove cushion assembly (see section 4.2.7.2 Cushion Removal).
9. Remove all urethane rivets and replace worn or broken component of cushion assembly.
10. Stack the Cushion Cover (090-005-279) and Rubber Cushion (000-024-807 or 000-024-808) on top of each other.
11. Pull new urethane cushion rivets through stack of Cushion Cover and Rubber Cushion. NOTE: Using a mild soap on the urethane cushion rivets will ease assembly.
12. Place Curtain Assembly (000-026-450), Sponge Rubber Cushion Pad (000-022-770), and Plank (000-024-795 or 000-024-796) on stack, and pull tails of urethane rivets through all holes. DO NOT PULL RIVETS ALL THE WAY THROUGH ASSEMBLY UNTIL ALL RIVET TAILS ARE THROUGH PLANK.
13. Working from the center of the plank to the ends, pull the urethane rivets through the cushion plank using the belt installation tool (784-003-000).
14. Go to step 12 in section 4.2.7.2 Cushion Removal.

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4.2.8. Pin Conveyor Belt & Adjustments

4.2.8.1. Belt Removal Procedure

CAUTION

Lockout/Tagout (LOTO) the machine being worked on as well as the machines on each side of the machine being worked on while replacing the belt.

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers. Repeat procedure for adjacent lane not of the pair.
8. Remove the EDGE Performance Lift from backend. Refer to the EDGE Performance Lift Manual (400-088-091-01).
9. Disconnect the pin conveyor drive belt from the drive pulley on the rear roller and remove the pulley from the roller.
10. Remove the paddle from the rudder arm.
11. Release the front roller from its bearing supports as follows:
    a. Insert the belt installation tool between the front roller and the tail plank.
    b. Apply pressure toward the rear of the machine. When the bearing support bracket clears the hole in the kickback plate, insert a retaining pin (792-501-001) into the hole.
    c. Repeat steps 11a and 11b for the other side of the machine.
12. Remove the front roller by rolling it over the bounce plate and out the ball exit opening into the adjacent machine.

CAUTION

Spring tension on the roller bearing support brackets should be removed while working in the pit. Personnel can be injured if a retaining pin is accidentally knocked out.

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13. Make the machine safe for entry as follows:
    a. Place the belt installation tool flag (792-502-002) onto the bearing support assembly (see Figure 4.2-36).
    b. Apply pressure toward the rear of the machine and remove the retaining pin from the hole in the kickback plate.
    c. Slowly release the tension on the bearing support assembly until it rests on the tail plank. **Do this procedure with caution.**
    d. Repeat steps 5a through 5c for the other side of the machine.
6. Unhook the rear roller support from its bracket and tip the rear roller from its bearing support.
7. Remove the rear roller passing it into the adjacent machine through the access hole in the kickback plate on the side opposite the ball exit side of the machine.

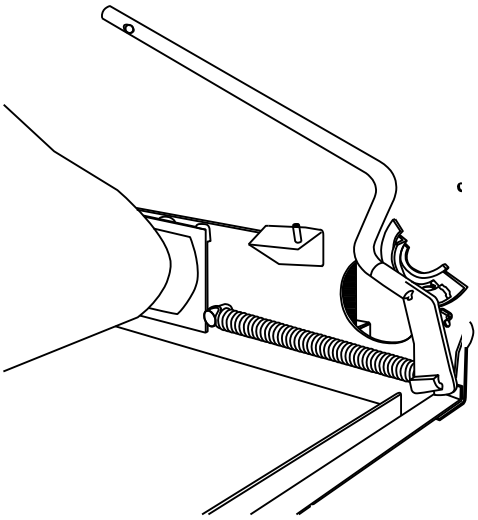

Figure 4.2-36

8. Remove the nuts securing the anti-idling bracket to the BDS side plate. Place the anti-idling bracket onto the bounce board and pass it through the ball exit opening into the adjacent machine.
9. Remove the four 5/16-inch nuts and washers that secure the vibration dampeners to the studs on the pit support brackets at each corner of the bounce board assembly.
10. Lift the belt and bounce board assembly off of the studs and remove it out the back of the pit.
11. Inspect for worn, broken or loose parts and hardware. Repair, replace and/or tighten as necessary.

4.2.8.2. Belt Replacement Procedure

1. Note the direction of the arrow on the belt. This may be located either on the inside or the outside of the belt.
    a. Place the bounce board assembly inside the belt with the V-shaped cutout toward the ball exit. The arrow on the belt must point in the direction the belt turns during operation.
    b. Wrap the belt around the bounce plate assembly and place it in the pit slightly forward on the pit support brackets. Do not fasten the bounce plate down at this time.
2. Install the rear roller by passing it from the adjacent machine on the side opposite the ball exit side of the machine, through the opening in the rear of the kickback plates and through

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the belt. The axle of the roller should protrude through the hole in the kickback plate and into the space occupied by the PBL.

3. Place the rear roller bearings in the bearing supports and hook the handle of the rear roller support bracket under the retaining tab on the kickback plate.
4. Install the drive pulley and conveyor drive belt.
5. Place the bounce plate in position inserting the studs on the pit support brackets through the mounting holes in the vibration dampers.
6. Place the free end of the grounding strap over the stud at the right rear vibration dampener and install the washers and 5/16-inch lock nuts onto the studs at each corner of the bounce plate assembly. Tighten securely. Make sure that the pin conveyor belt is free and not pinched between the bounce board and brackets.
7. Install the anti-idling bracket by passing it through the ball exit opening under the belt and place on top of the bounce board. Work the anti-idling bracket off the bounce board, aligning the studs into the holes in the BDS side plate. Install the 5/16” stover nuts, tighten securely.
8. Install the front roller by passing it through the ball exit opening of the adjacent machine and into the belt on top of the bounce board, but do not position in the bearing supports yet.
9. Before the front roller can be replaced, spring tension must be applied to the bearing support assemblies.

⚠ CAUTION **Keep your fingers clear of any moveable parts while applying spring tension. A severe pinching hazard exists.**

a. Place the flag on the belt installation tool, and hook the tool on the bearing support assembly as shown in Figure 4.2-36.

b. Apply pressure toward the rear of the machine until the bearing support bracket clears the hole in the kickback plate and insert the retaining pin into the hole. The belt installation tool can be rotated in the flag while applying pressure in order to provide additional clearance.

c. Repeat steps 9a and 9b for the other side of the machine.

d. Install the front roller in the bearing supports.

e. Grasp the end of the roller assembly on the top only and roll it into the support assembly. Repeat for the other end of the roller. Make sure that the roller bearings are fully seated in the bearing supports.

f. Apply pressure at one end of the front roller with the belt installation tool and remove the retaining pin. Carefully ease off on the roller. Repeat for the other end of the roller.

9. Reinstall the paddle on the rudder arm.

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10. Install the EDGE Performance Lift. Refer to the EDGE Performance Lift Manual Supplement.

NOTE: Some break-in may be required for certain styles of pit conveyor belts.

Electrical Drawings
Refer to Appendix A, the *EDGE Free Fall System Wiring Diagram, 088-200-678-xx.*

Distributor Adjustment and Maintenance
Refer to Appendix B, the *XLi Free Fall Distributor Manual*, *400-088-121-xx.*

Positive Ball Lift Adjustment and Maintenance
Refer to Appendix C, the *Positive Ball Lift Pinspotter Manual*, *400-088-011-xx.*

System Controller (Chassis)
Refer to Appendix D, the *EDGE Free Fall System Controller Manual*, *400-088-009-xx.*

Motors and Gearboxes
Refer to Appendix E, the *EDGE Free Fall Motor & Gearbox Manual, 400-088-038-.*

Pin Elevator
Refer to Appendix F, the *EDGE Performance Lift Manual, 400-088-091-xx.*

Manager's Control Unit (MCU)
Refer to Appendix G, the EDGE Free Fall *Manager's Control Unit (MCU) Manual, 400-088-051-xx.*

Radaray Foul Unit
Refer to Appendix H, the *Radaray Manual, 400-088-006-xx.*

Enhanced Guarding
Refer to Appendix I, the Enhanced Guarding *Manual, 400-088-099.*

Scoring Camera
Refer to Appendix J, the QV*3000 Camera Manual, 400-232-001-xx.* Note: QV3000 Camera is provided when there is no scoring connection to the pinspotter.

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4.3. **Critical Measurements**

Kickbacks / Pindeck	
Distance from back edge of kickback to 7 – 10 Line	6¼" (159 mm) New / 6¼"–6½" (159–165) Retrofit
Distance from wood part of kickback to center of the #7 and #10 Spots*	$12\frac{1}{16}" \pm \frac{1}{16}"$ (12"– $12\frac{1}{8}"$: 305–308 mm)
Distance from wood part of kickback to center of the #1 Spot*	$30\frac{1}{16}" \pm \frac{1}{16}"$ (30"– $30\frac{1}{8}"$: 762–765 mm)
Distance between kickbacks (wood to wood) across Lane*	$60\frac{1}{8}" \pm \frac{1}{8}"$ (60"– 60¼": 1524–1530 mm)
Distance from top of kickback to Pin Deck surface*	≥17"-17 1/16" (432-433 mm)
Dimension of cuts on back of Double Kickback Assembly	4" deep x 7" high (102 x 178 mm)
Flat Gutters	
Width of Flat Gutters (includes molding)*	9¼" ± ¼" (9"– 9½": 229–241 mm)
Depth of gutter opposite the #1 Spot*	≥$1\frac{7}{8}"$ (48 mm)
Depth of gutter at point opposite the #7 and #10 Spots*	3½" ± $\frac{1}{8}"$ ($3\frac{3}{8}"$– $3\frac{5}{8}"$: 86–92 mm)
Front End	
Distance from underside of frame to Pin Deck surface	$18\frac{7}{8}" \pm \frac{1}{8}"$ (18¾"– 19": 476–483 mm)
Height difference between corners of frame	$\frac{1}{32}"$ (1 mm)

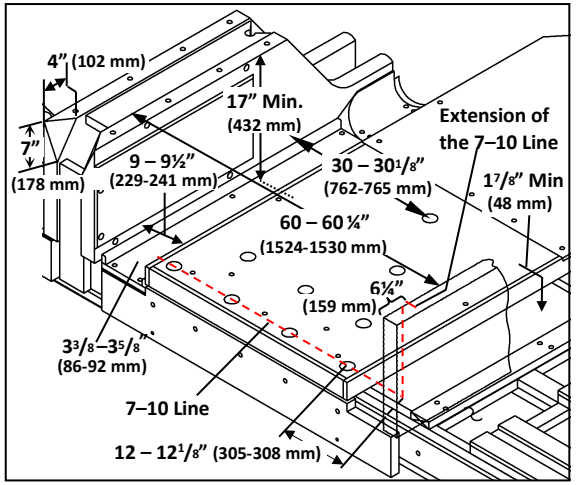

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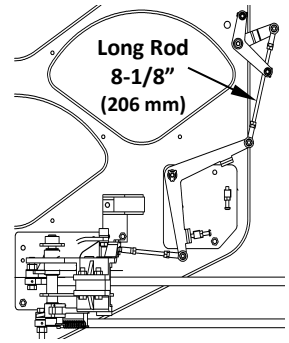
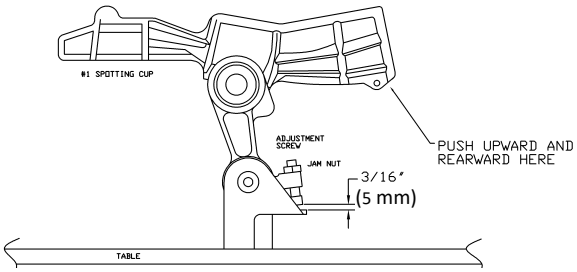
Table

Play in respot cell fingers	1/4"– 3/8" (6–9.5 mm) + equal finger to finger
Length of long rod at front of table	8 1/8" (206 mm)
Table position (Flags) max deviation from center of #1, #7, & #10 Spots	± 1/8" (3 mm)
Gap under table leg screw (cups horizontal)	3/16" (5 mm)
Gap under table leg screw (cups vertical – spot rod adjustment)	1/16"– 3/32" (1.5 –2.5 mm)
Gap between Pawl and point of Shifter Link	3/8" (9.5 mm)
Table height – Distance between pin deck and screw head	5/16" (8 mm)
Shuttle adjustment	2 1/2" (64 mm) - Initial Reference Measurement
Yoke spring position	Even with top of U-bolt nut

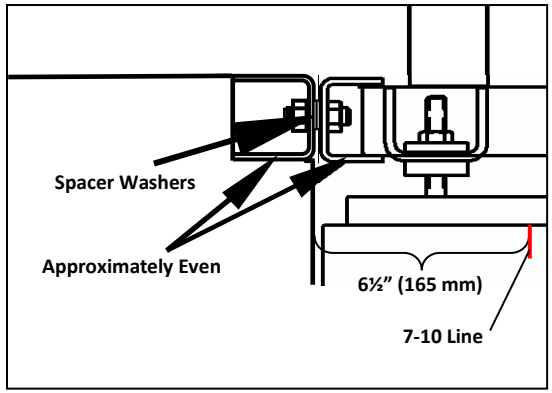
Back End

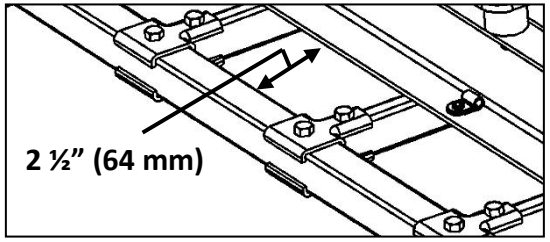
Distance from front edge of side plate flange to 7–10 Line	6½" (165 mm) New / 6½"–6¾" (165–171 mm) Retrofit
Back End height vs. Front End height at connection points	Approximately Even

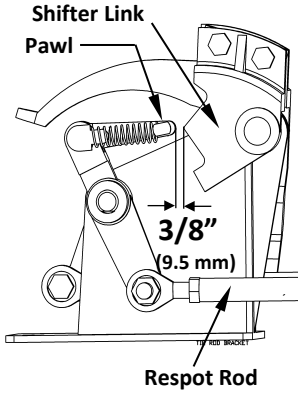




Gap Under Table Leg Screw (Cups Horizontal)







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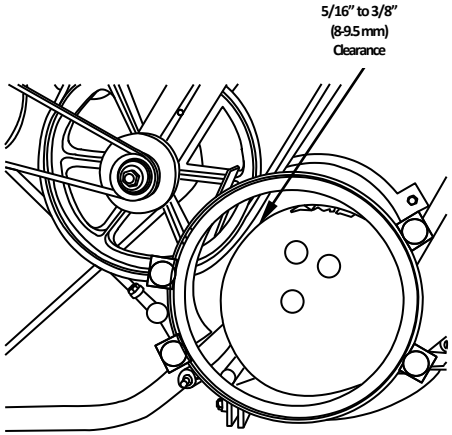
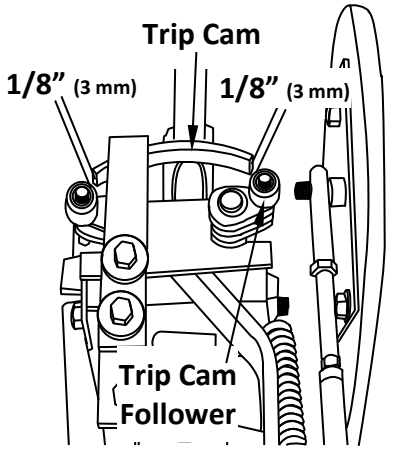
PBL	
Lift arm height above door weldment	1/8" to 3/16" (3–5 mm) above weldment
PBL height (clearance between ball on lift arm and lift belt)	5/16"–3/8" (8–9.5 mm)
LBS	
Distance LBS should travel after rudder hits bumper	1/16" – 1/8" (1.5–3 mm)
Gap between Trip Cam and followers (L&R) with rudder centered	1/8" (3 mm)
Distributor	
Distributor Spacer 070-006-143	Used on Distributor Post
Distributor Mount	One side must contact Rear Dist. Crossbeam Support
Distance between trip arms	3" (76 mm) Max
Clearance between belt guard and ridge on bin	¼" – ½" (6–13 mm)
Sweep	
Length of each long rod	10 threads showing (total of both ends); 12 on 7-pin side
Distance above pin deck at 1st Guard	1 1/8" ± 1/8" (1"– 1¼": 25–32 mm)
Distance above pin deck at the center of the #4, #5, & #6 Spots	3/16" ± 1/16" (1/8"– 1/4": 3–6 mm)
Maximum rearward travel (manually cranked)	Front of bar at back of 7 -10 row
Ball Detector	
–SINGLE SENSOR BEAM – INSTALL INSIDE THE PATH OF THE SWEEP–	
Distance from center of detector/reflector to the 7–10 Line	51 ½"" ± 1" (50 1/2"– 52 1/2": 1283–1334 mm)
Thickness of board used to mount detector to nose of kickback	1"x 6"x 9 ½" lumber (3/4" x 5 ½" x 9 ½" actual) (19mm x 140mm x 241mm)





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Section 4B MAINTENANCE

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Contents

Section 4 B MAINTENANCE 4-61
4.4. Lubrication 4-65
4.4.1. Lubrication Instructions & Symbols 4-65
4.4.2. Table Drive Assembly 4-67
4.4.3. Sweep Drive and Linkages 4-71
4.4.4. Respot Cells 4-73
4.4.6. Yoke Assembly 4-74
4.4.7. Table Shifter Mechanism 4-75
4.4.8. Table Actuator and Connector Assemblies 4-76
4.4.10. Durabin & Shuttle Assembly 4-77
4.4.11. Shock Absorber 4-78
4.4.12. Backend Side Plate Assembly 4-79
4.5. Scheduling Preventive Maintenance 4-80
4.5.1. QubicaAMF Weekly Preventive Maintenance Chart 4-80
4.5.2. Preventive Maintenance Schedule 4-81
4.6. Maintenance Procedures 4-87
4.6.1. 25,000 Frame Maintenance 4-87
4.6.1.1. Clean O-Pan and Distributor Funnels 4-87
4.6.1.2. Clean EDGE Lift 4-88
4.6.1.3. Clean Durabin and Shuttle 4-89
4.6.1.4. Clean PBL & Uprail Assembly 4-90
4.6.1.6. Clean Ball Door Exit, Lift Arm and LBS Paddle 4-91
4.6.1.7. Service the Distributor Clutch Assembly 4-91
4.6.2. 50,000 Frame Maintenance 4-92
4.6.2.1. Clean the Pit Conveyor Belt 4-92
4.6.2.2. Service the Table Assembly 4-92
4.6.2.3. Service the Sweep Assembly 4-93
4.6.2.4. Service the Cushion Assembly 4-94
4.6.2.5. Service the Shuttle Assembly 4-95
4.6.2.6. Service the Front End Motor (Table & Sweep) Brakes and Encoders 4-96
4.6.3. 100,000 Frame Maintenance 4-96
4.6.3.1. Home Disc Cleaning 4-96

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4.6.3.2. Clean Machine Framework 4-96
4.6.3.3. Check all Machine Belts 4-97
4.6.3.4. Check & Tighten Front End Unistrut Jack Screw & Jam Nuts 4-98
4.6.3.5. Check for Missing Back End Jackscrew Locks 4-98
4.6.3.6. Check the Alignment of the Spot/Respot Cams and Levers 4-99
4.6.3.7. Sweep Home Disc Adjustments 4-101
4.6.3.8. Table Home Disc Adjustments 4-102
4.6.3.9. Check Light Ball Sensor Operation 4-103
4.6.3.10. Clean the Distributor Assembly 4-103
4.6.3.11. Service the Distributor Drive Shaft Assembly 4-103
4.6.3.12. Service the EDGE Performance Lift Check and Tighten Hardware 4-103
4.6.3.13. Service the Cushion Shock Assembly 4-104
4.6.3.14. Service the Downsweep and Transition Track 4-105
4.6.4. 200,000 Frame Maintenance 4-106
4.6.4.1. Service the Sweep Gearbox – Change the Gearbox Oil 4-106
4.6.4.2. Service the Table Gearbox – Change the Gearbox Oil 4-106
4.6.4.3. Service the EDGE Performance Lift Track & Chain Assembly 4-106
4.6.4.4. Service the Pit Conveyor Rollers and Pit Assembly 4-106
4.6.5. 500,000 Frame Maintenance 4-109
4.6.5.1. Service the Positive Ball Lift Assembly 4-109
4.6.5.2. Service the Back End Motor & Gearbox 4-109
4.6.5.3. Service the Light Ball Sensor (LBS) Assembly 4-109
4.6.5.4. Service the Distributor Assembly 4-109
4.6.5.5. Service the Sweep Motor & Gearbox – Coupling & Output Shaft Inspection 4-109
4.6.5.6. Service the Table Motor & Gearbox – Coupling & Output Shaft Inspection 4-109
4.6.5.7. Service the Table Drive 4-110
4.6.5.8. Service the Shuttle Rod Assembly 4-111
4.6.5.9. Service the Shifter and Cam Link Needle Bearings 4-113

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4.4. Lubrication

4.4.1. Lubrication Instructions & Symbols

Lubrication is one of the most important items in the proper operation and maintenance of the EDGE Free Fall Pinspotter. Care must be taken to ensure that lubricants are applied correctly. Avoid excessive lubrication to minimize the possibility of transmitting lubricants to the bowler. Before lubricating exposed parts or surfaces, it is important that the old lubricant first be removed. It is also very important to clean the pinspotter as you lubricate.

Table 4.4-1 provides a quick look at the items requiring lubrication as well as the lubrication frequency and Figure number (drawing) that should be referenced for more information. The Figures that follow the Lubrication Schedule show the specific points of lubrication, the correct amount of lubricant to use, and the frequency of lubrication for each part of the machine that requires periodic lubrication.

Lubrication of the Distributor, Positive Ball Lift (PBL), and Front & Back End Gearboxes is covered in their respective manuals.

Lubricant Symbols

1 **Oiling:** Items indicated by a number within a square require oiling. Use SAE #10 oil as the lubricant.

(1) **Greasing:** Items indicated by a number within a circle require greasing. Use a multipurpose grease (such as Bearing Guard #2) as the lubricant.

NOTES: There are 52 uniball rod ends on each pair of EDGE Free Fall Pinspotters. Although they are considered greaseless and maintenance free, an occasional drop of oil on a rod end may be desired to prevent squeaking.

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Table 4.4-1, Lubrication Schedule

	Table/Table Drive	Oil/Grease	Figure
EVERY 50,000 FRAMES	Spotting hook pivot bushings	Oil	4.3-3b
	Upper spotting link assembly bushings	Oil	4.3-3b
	Solenoid linkages	Oil	4.3-3b
	Ball joint assemblies	Oil	4.3-3b
	Cam lever shaft	Oil	4.3-3c
	Roller arm assembly	Oil	4.3-3c
	Crank housing	Oil	4.3-3c
	Latch pivot	Oil	4.3-3c
	Off-spot lever pivot	Oil	4.3-3c
	Spring hanger pivot bolts	Oil	4.3-3c
	Spring hook bushings	Oil	4.3-3d
	Respot cell lever	Oil	4.3-5
	Respot cell pivot points	Oil	4.3-5
	Carburetor links	Oil	4.3-5
	Pivot washers	Oil	4.3-5
	Finger lever bushings	Oil	4.3-7a
	Finger link	Oil	4.3-7a
	Spot lever	Oil	4.3-7b
	Front actuator assembly bushings	Oil	4.3-8
	Front connecting link assembly bushings	Oil	4.3-8
	Table spot and respot cams	Grease	4.3-3a
	Shuttle cam	Grease	4.3-3a
	Spot and respot cam follower bearing	Grease	4.3-3b
	Spot and respot levers	Oil	4.3-3b
	Shuttle cam follower	Grease	4.3-3c
	Sweep/Sweep Drive	**Oil/Grease**	**Figure**
	Linkage knuckles	Oil	4.3-4a
	Linkage joints	Oil	4.3-4a
	Sweep motor tie rod assembly	Oil	4.3.4b
	Yoke Assembly	**Oil/Grease**	**Figure**
	Rear leg bushings	Oil	4.3-6
	Linkage rod pivot points	Oil	4.3-6
	Front leg lower bushings	Oil	4.3-6
	Shuttle pivot shaft sleeve bearings	Oil	4.3-9
	Back End side plate front roller bearing bracket	Oil	4.3-11
EVERY 100,000 FRAMES	**Table/Table Drive**	**Oil/Grease**	**Figure**
	Table drive eccentric assembly	Grease	4.3-3c
	Cam ball	Grease	4.3-3c
	Inside of clevis	Grease	4.3.3c
	Table support weldment sleeve bearings	Oil	4.3-3d
	Respot cell finger slots	Grease	4.3-5
	Shifter link and cam link needle bearings	Grease	4.3-7a & b
	Cam Link	Grease	4.3-7a
	Shifter Link	Grease	4.3-7a
	Actuator arm inside surface	Grease	4.3-7b
	Sweep/Sweep Drive	**Oil/Grease**	**Figure**
	Inside guide tube	Grease	4.3-4a
	Miscellaneous	**Oil/Grease**	**Figure**
	Shock absorber pivot pins	Oil	4.3-10
	Back End side plate rear roller support bushing	Oil	4.3-11

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4.4.2. **Table Drive Assembly**

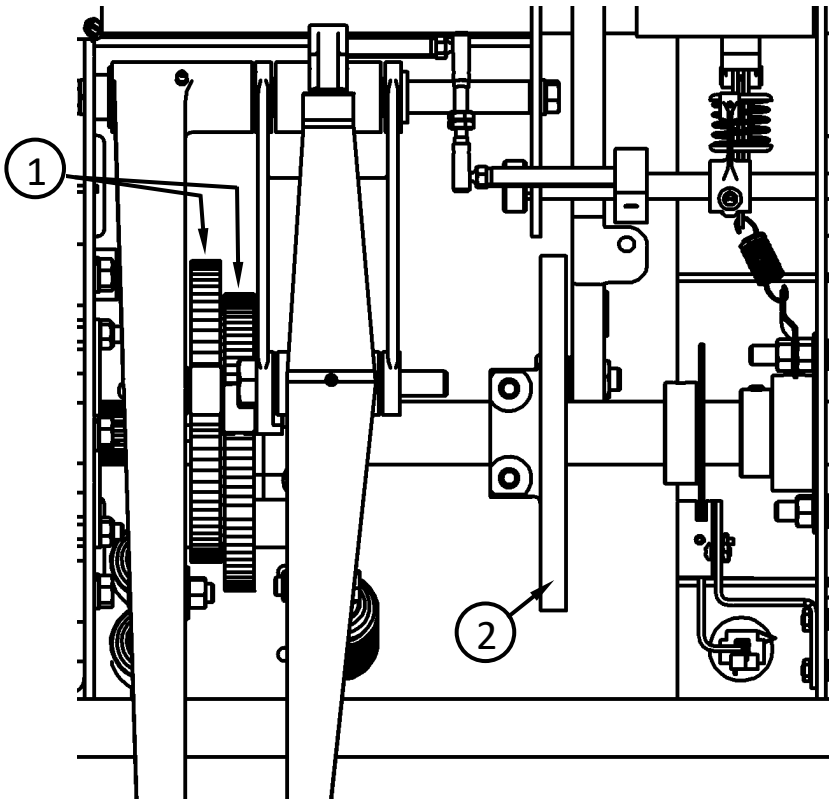

Figure 4.4-3a

CAUTION

Watch out for sharp edges on the Shuttle Cam and the Table Spot and Respot Cams.

Every 50,000 frames:

1. Apply a light coating of grease on the table spot and respot cams.
2. Apply a light coating of grease on the shuttle cam.

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Table Drive Assembly - Continued

Every 50,000 frames:

1. Spotting hook pivot bushings: 1 drop of oil (2 places).
2. Upper spotting link assembly bushings: 1 drop of oil (2 places).
3. Solenoid linkages: 1 drop of oil (6 places).
4. Ball joint assemblies: 1 drop of oil (2 places).

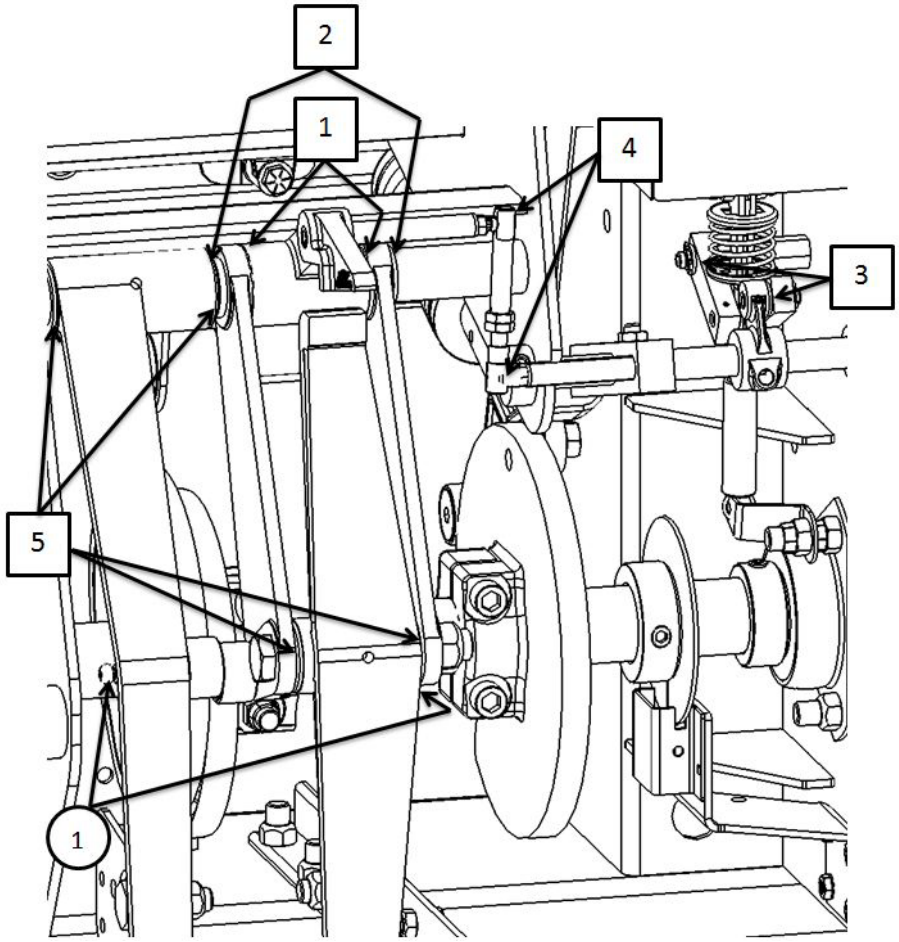

Figure 4.4-3b

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Every 50,000 frames:

1 5. Grease the spot and respot cam follower bearing.

5 6. Oil the spot and respot levers.

Table Drive Assembly - Continued

Every 50,000 frames:

1 1. Cam lever shaft: 1 drop of oil (4 places).

2 2. Roller arm assembly: 1 drop of oil (3 places).

3 3. Crank housing: 1 drop of oil (2 places).

4 4. Latch pivot: 1 drop of oil (2 places).

5 5. Off-spot lever pivot: 1 drop of oil (2 places).

6 6. Spring hanger pivot bolts: 1 drop of oil (2 places).

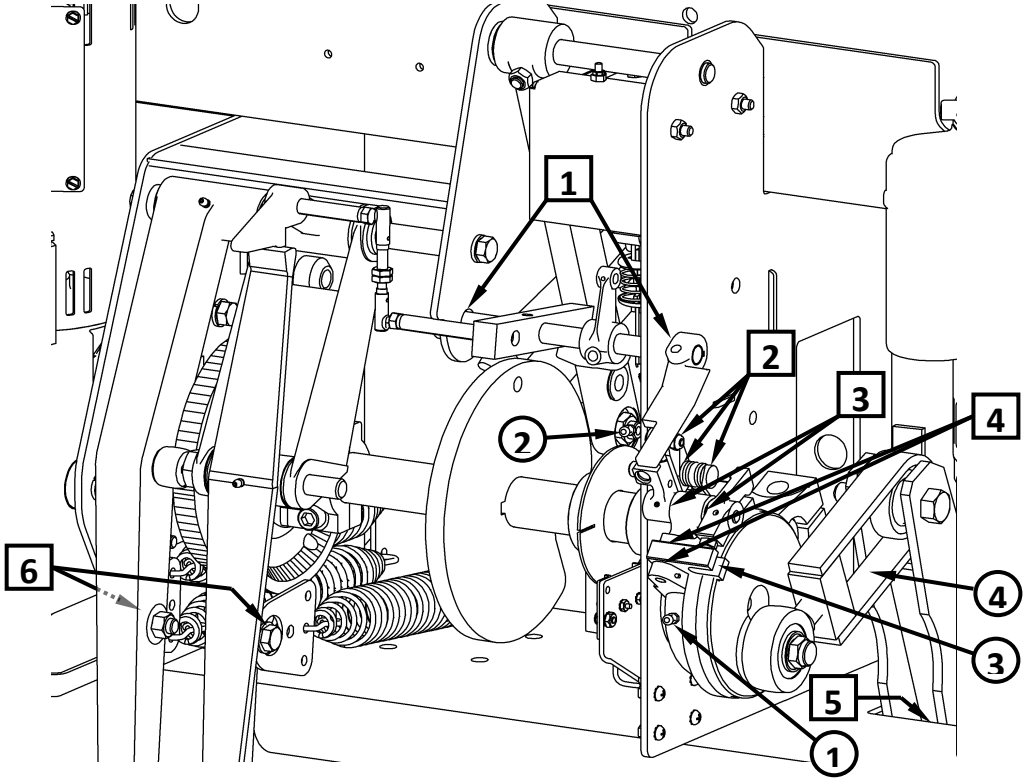

Figure 4.4-3c

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(1) 7. Grease the table drive eccentric assembly **every 100,000 frames**.

(2) 8. Apply grease to the shuttle cam follower **every 50,000 frames**.

(3) 9. Apply a light coating of grease to the cam ball **every 100,000 frames**.

(4) 10. Apply a light coating of grease to the inside of the clevis **every 100,000 frames**.

Table Drive Assembly - Continued

[2] 1. Table support weldment sleeve bearings: 4 drops of oil (2 places) **every 50,000 frames.**

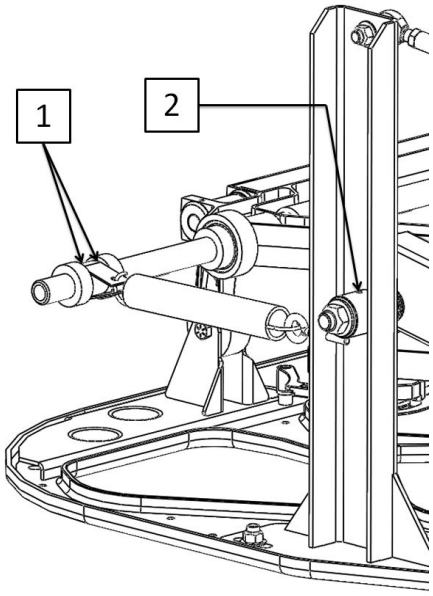

Figure 4.4-3d

[1] 2. Spring hook bushings: 1 drop of oil (4 places) **every 50,000 frames**.

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4.4.3. **Sweep Drive and Linkages**

NOTE: Only one side of the sweep linkage is shown. Totals reflect both sides.

Every 50,000 frames:

1. Linkage knuckles: 4 drops of oil on each knuckle (8 places).
2. Linkage joints: 2 drops of oil on each joint (8 places).

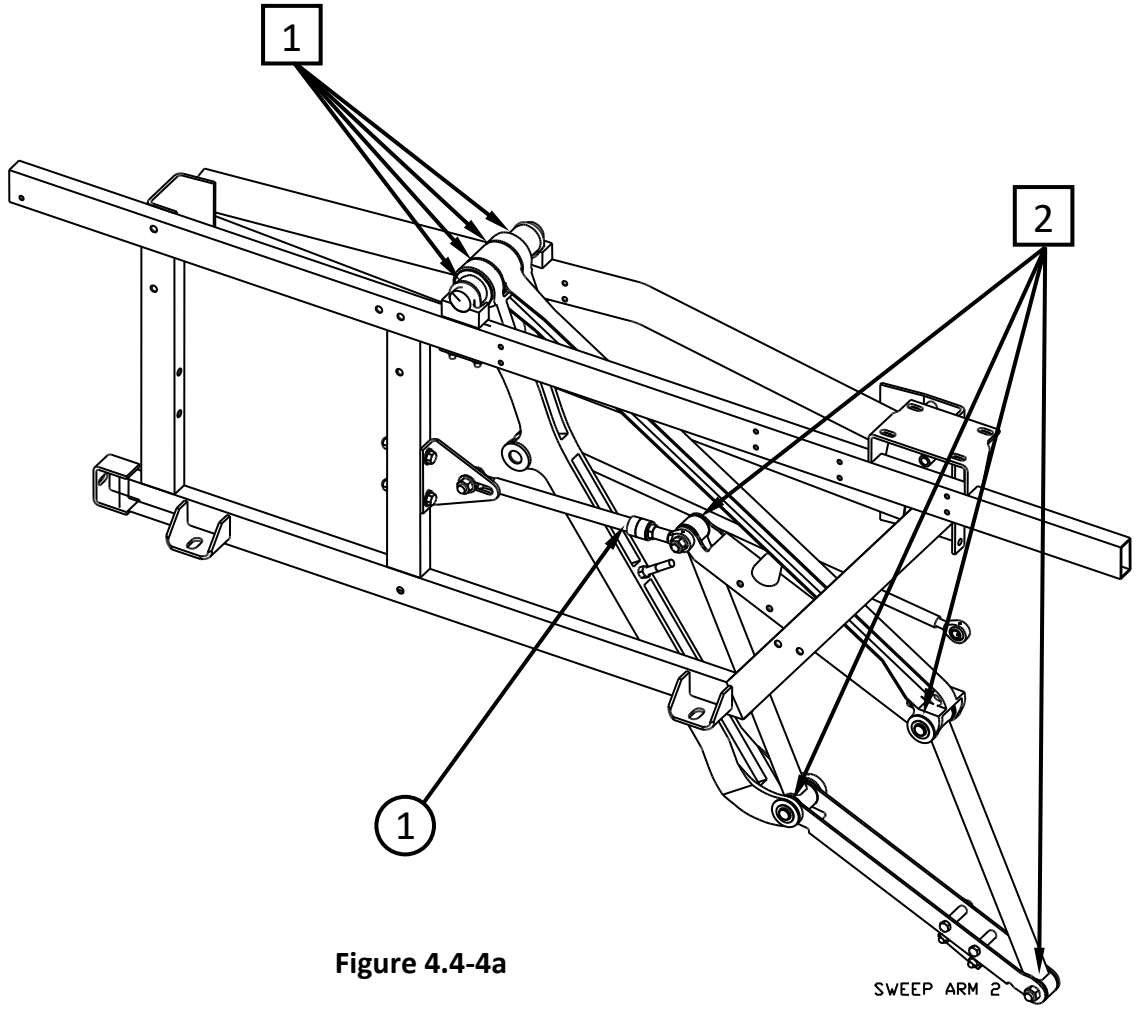

Figure 4.4-4a

(1) 3. Inside guide tube: clean and grease **every 100,000 frames**.

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Sweep Drive and Linkages - Continued

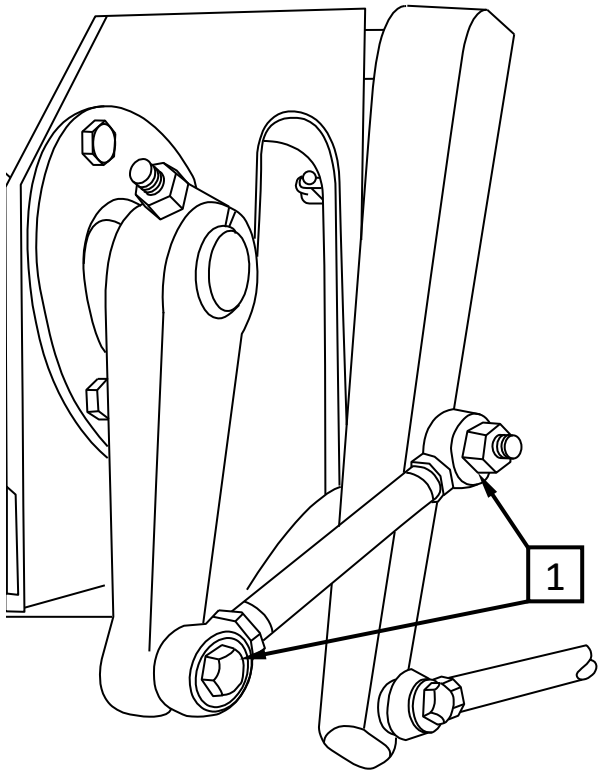

Figure 4.4-4b

1. Sweep motor tie rod assembly: 2 drops of oil (2 places) **every 50,000 frames**.

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4.4.4. **Respot Cells**

Every 50,000 frames:

1. Respot cell lever: 1 drop of oil on each lever (10 per machine).
2. Pivot points: 1 drop of oil on each pivot point (10 cells per machine).
3. Carburetor links: 1 drop of oil at each end (6 links per machine).
4. Pivot washers: 1 drop of oil on each washer (2 places per cell).

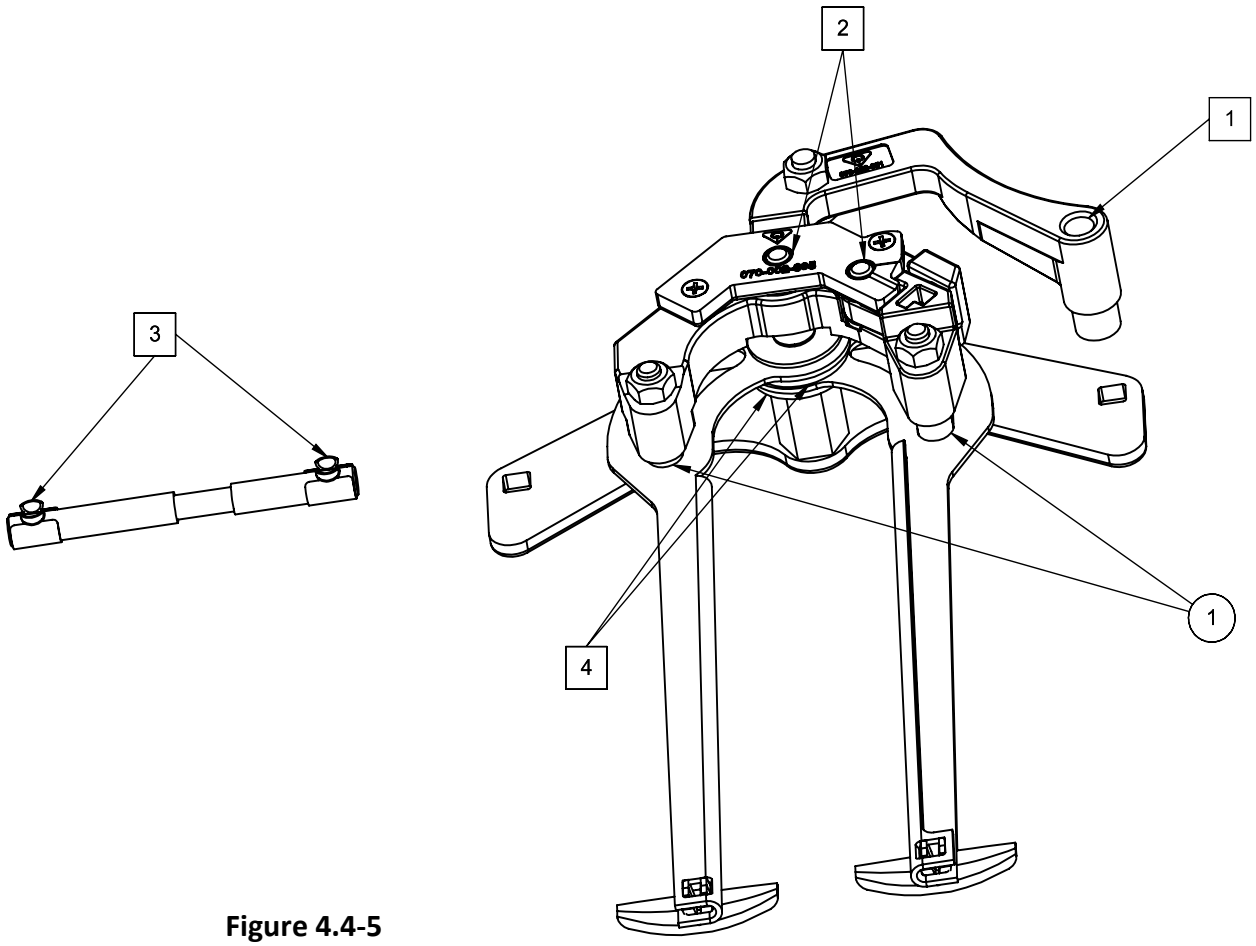

Figure 4.4-5

1. Respot cell finger slots: apply a light film of grease along the bottom perimeter of each slot (20 places) **every 100,000 frames**.

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4.4.6. **Yoke Assembly**

Every 50,000 frames:

1. Rear leg bushings: 2 drops of oil on each side (8 places).
2. Linkage rod pivot points: 1 drop of oil (4 places).
3. Front leg lower bushings: 2 drops of oil each side (4 places).

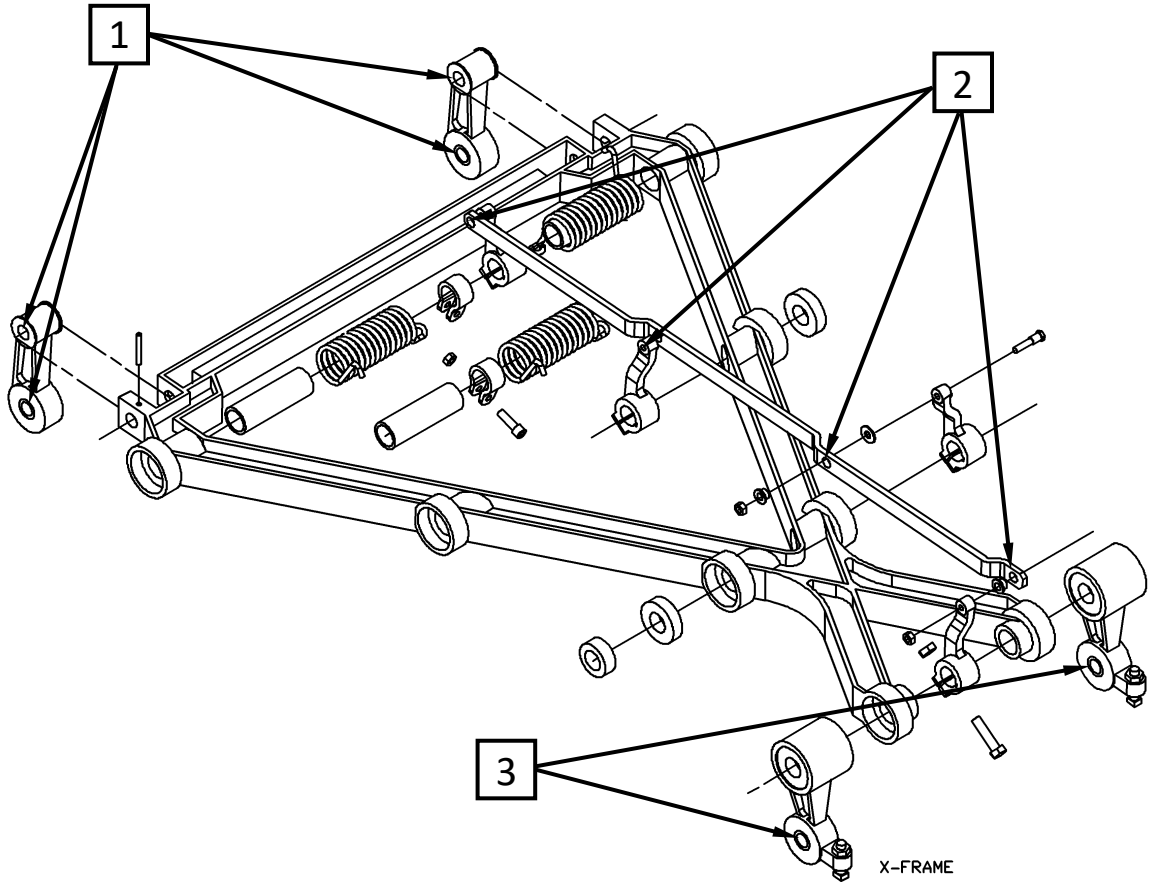

Figure 4.4-6

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4.4.7. **Table Shifter Mechanism**

Every 50,000 frames:

1. Finger lever bushings: 1 drop of oil (2 places).
2. Finger link: 1 drop of oil (2 places).
3. Spot lever: 1 drop of oil (2 plac

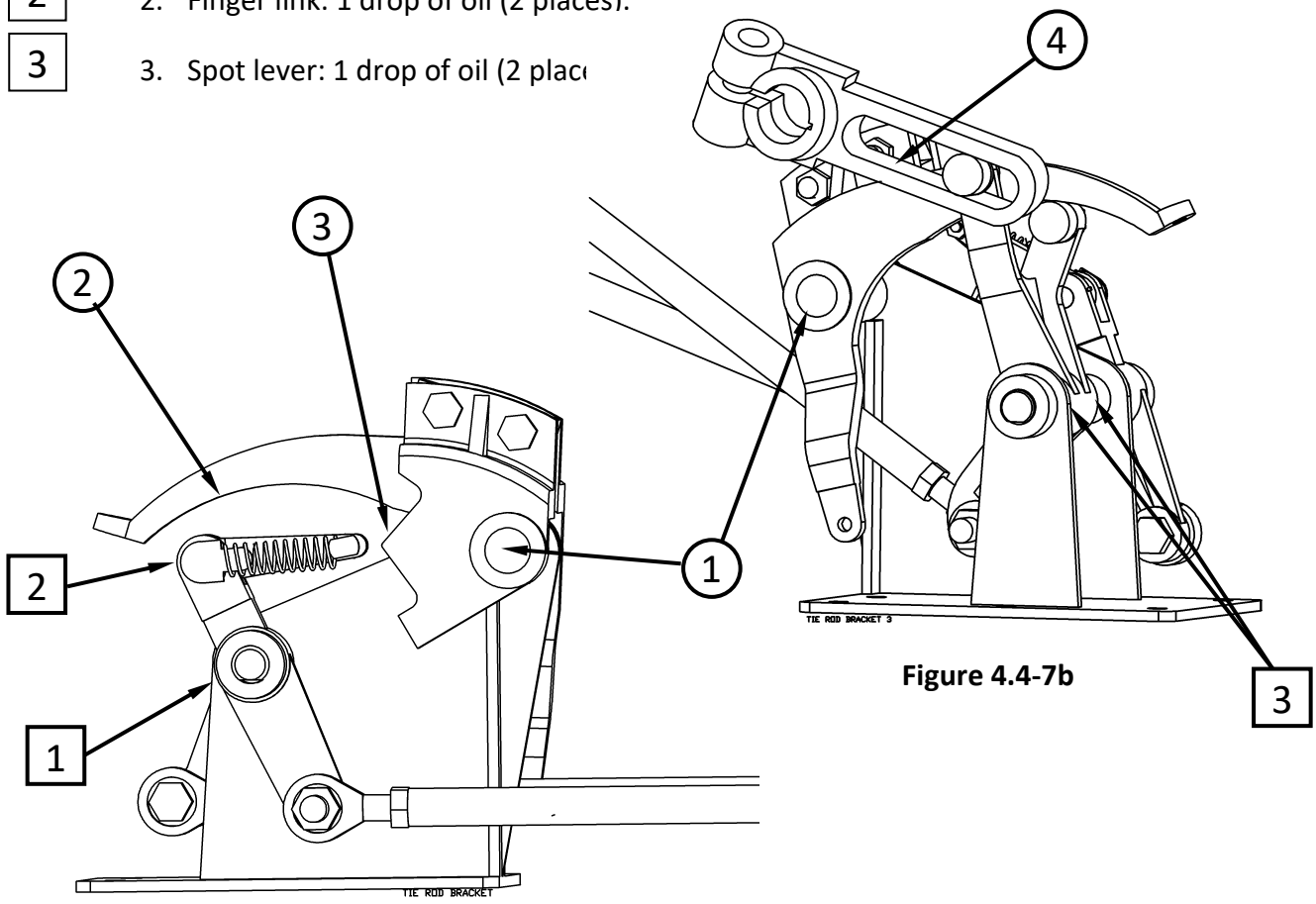

Figure 4.4-7b

Figure 4.4-7a

Every 100,000 frames:

1. 4. Shifter Link and cam link: repack needle bearings (2 places).
2. 5. Cam Link: apply a light coat of grease to the underside (1 place).
3. 6. Shifter Link: apply a light coat of grease (1 place).
4. 7. Actuator Arm: apply a light coat of grease to the inside surface (1 place).

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4.4.8. **Table Actuator and Connector Assemblies**

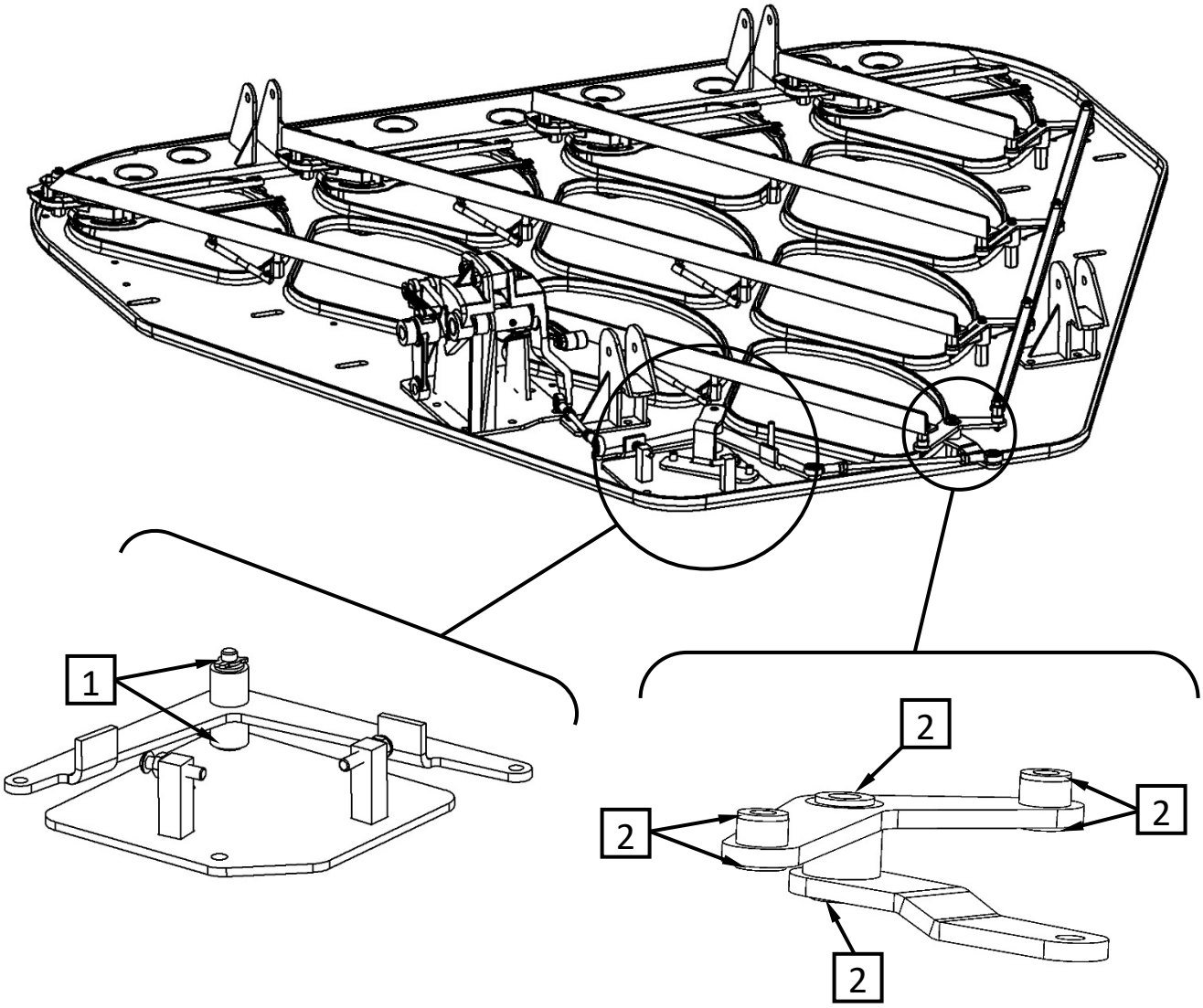

Figure 4.4-8

Every 50,000 frames:

1. Front actuator assembly bushings: 1 drop of oil (2 places).

2. Front connecting link assembly bushings: 1 drop of oil (6 places).

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4.4.10. **Durabin & Shuttle Assembly**

1

1. Shuttle pivot shaft sleeve bearings: 2 drops of oil (6 places) **every 50,000 frames**.

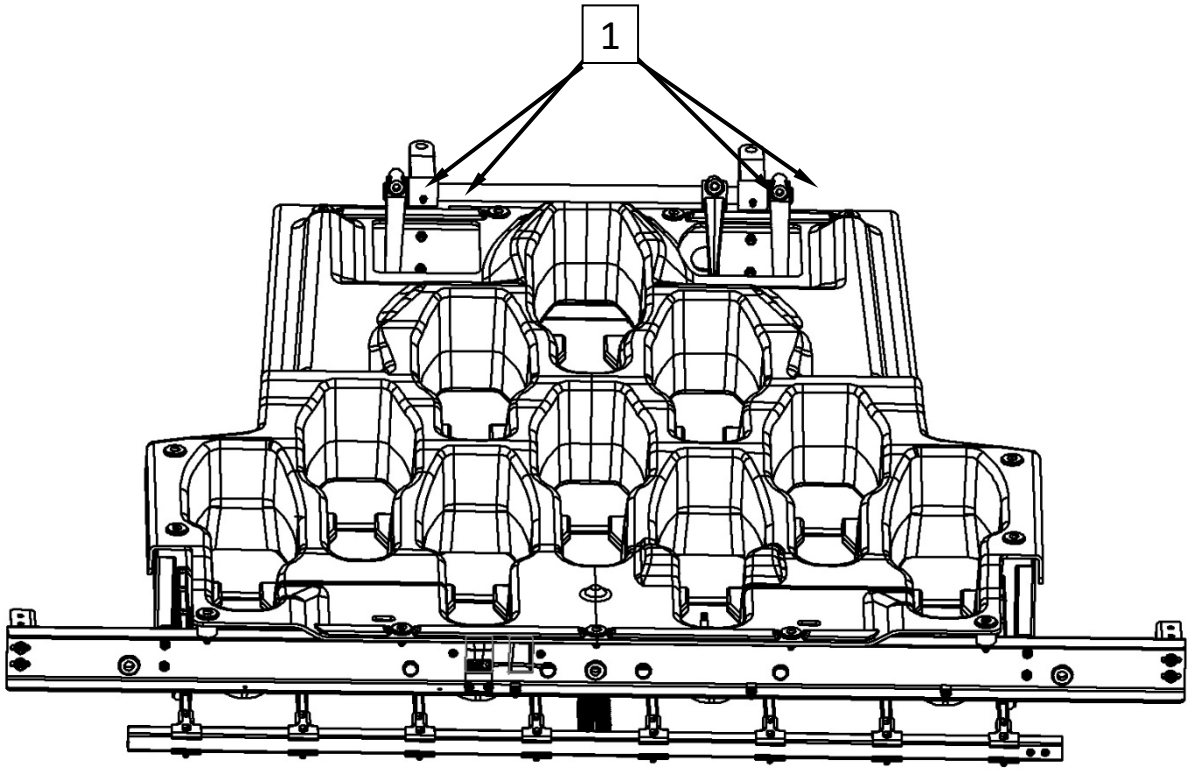

Figure 4.4-9

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4.4.11. **Shock Absorber**

1 1. Pivot pins: apply 2 drops of oil every (4 places) **every 100,000 frames**.

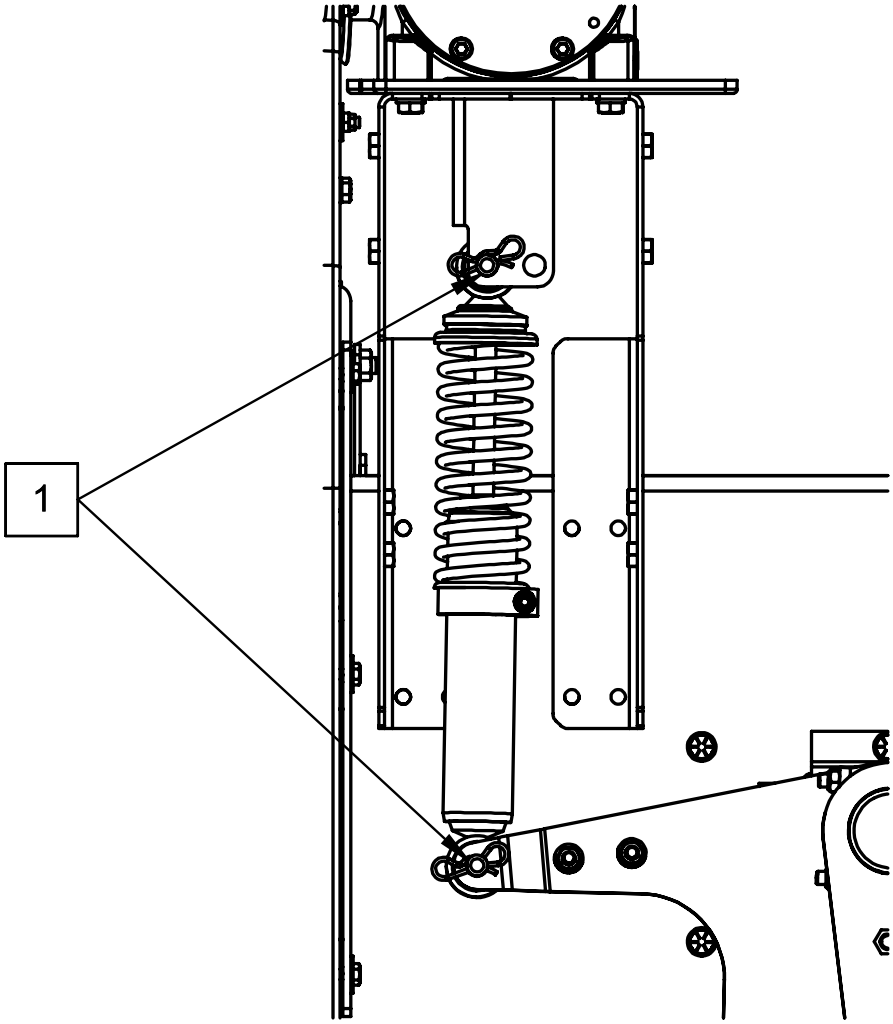

Figure 4.4-10

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4.4.12. **Backend Side Plate Assembly**

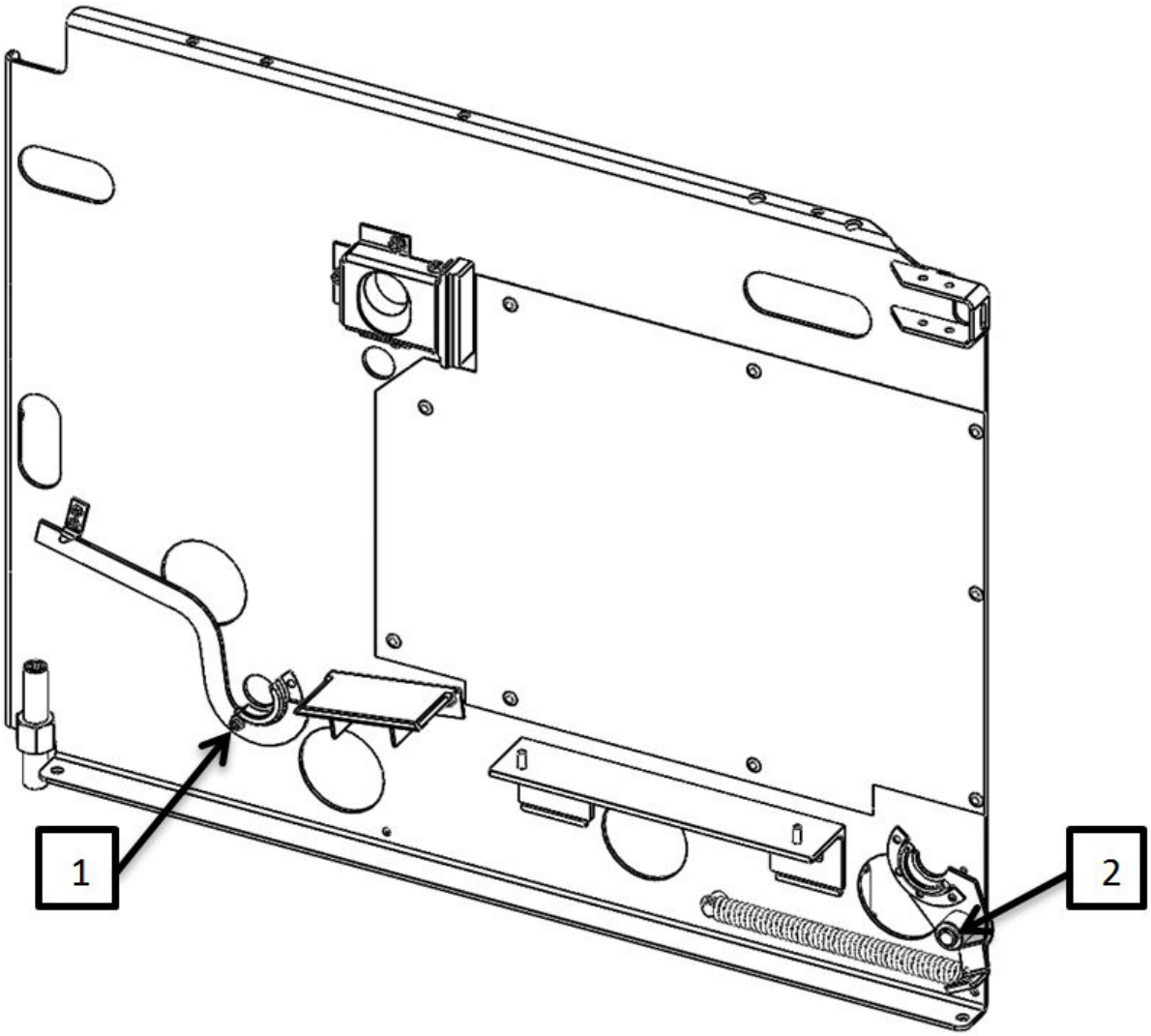

Figure 4.4-11

2

1. Bracket bearing support assemblies: 2 drops of oil (2 places) **every 50,000 frames**.

1

2. Rear roller support weldment bushing (1 place): 1 drop of oil **every 100,000 frames**.

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4.5. **Scheduling Preventive Maintenance**

4.5.1. **QubicaAMF Weekly Preventive Maintenance Chart**

Preventive maintenance is performed by the proprietor's maintenance technician using in accordance with the schedule shown on the following pages. Each machine is given this check according to the frequency indicated. Table 4.6-1 provides a quick and easy method of dividing the weekly maintenance items. For example, the maintenance technician of a 16-lane house would do four pinspotters a day for four days each week. The items that are performed according to frame count should be penciled in on the weekly chart as they become due.

Table 4.6-1

TYPICAL PINSPOTTER INSPECTION SCHEDULE														
Number of Pinspotters														
DAY	6	8	10	12	14	16	18	20	22	24	26	28	30	32
MON.	2	2	2	4	4	4	4	4	5	5	6	6	6	8
TUES.	2	2	2	4	4	4	4	4	5	5	5	6	6	6
WED.	2	2	2	4	4	4	4	4	4	5	5	6	6	6
THURS.		2	2		2	4	4	4	4	5	5	5	6	6
FRI.			2				2	4	4	4	5	5	6	6

If your bowling center has more lanes than shown in the table, you can determine your schedule by adding the totals from two columns. For example, if your center has 36 lanes, add the numbers from the **30** column to the numbers from the **6** column for each day of the week. In this case, your schedule would be: **8, 8, 8, 6, 6 = 36**. If the number of lanes in your center is an exact multiple of one of the numbers shown in the table, simply multiply the number of lanes for that day by the multiple. For example, if your center has 48 lanes, multiply the numbers in the **24** column by **2**, which result in **10, 10, 10, 10, 8 = 48**. Alternately, you could have added the numbers in the **28** and **20** columns to get **10, 10, 10, 9, 9 = 48**, which is also acceptable.

Table 4.6-2 shows the scheduling frequency for servicing pinspotters based on frame count. The following pages specify the maintenance frequency of various pinspotter components, and Section 4.5 contains the specific procedures for servicing activities that require more detailed instructions.

Table 4.6-2

Service Frequency	50k	75k	100k	125k	150k	175k	200k	225k	250k	275k	300k	325k	350k	375k	400k	500k
50K Item	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
100K Item			☑				☑				☑				☑	☑
200K Item							☑								☑	☑
500K Item																☑

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4.5.2. **Preventive Maintenance Schedule**

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Daily

Review Qportal for previous day errors		
Investigate / correct machines that have developed a malfunction pattern.		
Clean Positive Ball Lift (PBL) Belt with a dry rag		
Clean Distributor Belt with a dry rag		
Assign and record completed PM on the PM charts		

Weekly

Inspect the Carrier Rails for correct installation direction (pointed end down)		
Inspect Kickout Springs (2 per machine) – missing, bent, or loose		
Remove, launder, and install Ball Wipes and Dust Collector Cloths		
Inspect Distributor, observe for proper operation, correct as needed		

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Every 25,000 Frames

Clean PBL & Uprail Assembly – check for loose hardware		
Clean the Ball Door Exit, Lift Arm, and LBS Paddle		
Clean the EDGE Lift		
Service the Distributor Clutch Assembly (refer to the *EDGE Free Fall Distributor Manual*)		
Clean Durabin and Shuttle		
Clean O-Pan and Distributor Funnels		

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Every 50,000 Frames

Clean the Pit Conveyor Belt		
Service the Table Assembly.		
Service the Sweep Assembly.		
Service the Cushion Assembly.		
Service the Shuttle Assembly.		
Complete 50,000 Frame Scheduled Lubrication.		
Service the Front End Motor (Sweep & Table) Brakes & Encoders (refer to the EDGE Free Fall Motor & Gearbox Manual)		

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Every 100,000 Frames

Clean the Machine Framework.		
Check all Machine Belts.		
Check and Tighten Front End Unistrut Jackscrew Jam Nuts.		
Check for missing Back End Jackscrew Locks.		
Check Alignment of Spot/Respot Cam to Spot/Respot Levers.		
Home Disc Cleaning.		
Check the Sweep Home Stopping Position.		
Check the Table Home Stopping Position.		
Check LBS operation (refer to the *Positive Ball Lift (PBL) Manual*).		
Clean the Distributor Assembly (refer to the *EDGE Free Fall Distributor Manual*).		
Service the Distributor Drive Shaft Assembly (refer to the *EDGE Free Fall Distributor Manual*).		
Service the Cushion Shock Assembly.		
Service the Down Sweep and Transition Track.		
Complete 100,000 Frame scheduled Lubrication.		
EDGE Lift – Check and Tighten Hardware (Refer to EDGE Performance Lift Manual).		

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Every 200,000 Frames

Service the EDGE Performance Lift and Track/Chain Assembly (refer to the *EDGE Performance Lift Manual)*		
Service the Pit Conveyor Rollers and Pit Assembly		
Service the Sweep Gearbox – Change the Gearbox Oil (refer to the EDGE Free Fall Motor & Gearbox Manual)		
Service the Table Gearbox – Change the Gearbox Oil (refer to the EDGE Free Fall Motor & Gearbox Manual)		

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Every 500,000 Frames

Service the Positive Ball Lift (PBL) Assembly (refer to the *Positive Ball Lift (PBL) Manual*)		
Service the Light Ball Sensor (LBS) Assembly (refer to the *Positive Ball Lift (PBL) Manual*)		
Service the Distributor Assembly (refer to the *EDGE Free Fall Distributor Manual*)		
Service the Table Drive.		
Service the Shuttle Rod Assembly.		
Service the Shifter and Cam Link Needle Bearings.		
Service the Sweep Motor & Gearbox – Coupling and Output Shaft Inspection (refer to the EDGE Free Fall Motor & Gearbox Manual)		
Service the Table Motor & Gearbox – Coupling and Output Shaft Inspection (refer to the EDGE Free Fall Motor & Gearbox Manual)		
Service the Backend Motor & Gearbox (refer to the EDGE Free Fall Motor & Gearbox Manual)		

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4.6. **Maintenance Procedures**

This section provides specific preventive maintenance instructions for servicing pinspotters on a frequency based on frame count. This has been determined to be a more reliable and efficient method because it is based on actual machine use. Generally, the longer the service interval, the more significant the maintenance activity. Repeat each maintenance item at every multiple of the indicated frame count. For example, a maintenance activity performed at 25,000 frames would be repeated at 50,000, 75,000, 100,000, 125,000, etc. A 100,000 frame maintenance activity is repeated at 200,000, 300,000, etc. Maintenance may need to be done more frequently based on a pinspotter's age, mechanical condition, and repair history.

This section, as well as the corresponding sections in the accompanying manuals, provides details relating to the required pinspotter maintenance. For example, simply stating "Service the Distributor Clutch Assembly" in the Preventive Maintenance Schedule (Section 4.4) doesn't provide the technician with enough information to perform the task as intended by the manufacturer. The additional information, which in this example is located in the accompanying *EDGE Free Fall Distributor Manual*, gives specific details that should result in more consistent pinspotter performance from machine to machine, from technician to technician, and from center to center.

While each maintenance activity is written as a standalone instruction, other maintenance items that are due to be performed can be grouped together and performed at the same time in order to minimize repeating activities and to take advantage of such things as tagging out the pinspotter, gathering tools, cleanup, etc.

4.6.1. **25,000 Frame Maintenance**

4.6.1.1. **Clean O-Pan and Distributor Funnels**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing toward that lane.
2. Press MODE button to place pinspotter into mechanic mode.
3. Press SWEEP RUN button until sweep is at 1st guard position.
4. Switch off both breakers on system controller.
5. Implement Lockout/Tagout (LOTO).
6. Deploy lane barriers.
7. Remove crow's nest side guard.
8. Unlatch curtain - drape curtain over cushion assembly.
9. Climb into pit.
10. Using a shop towel, spray with a water base cleaner.
11. Wipe o-pan and distributor funnels.
12. Using a clean shop towel, spray with a vinyl type dressing (Armor-All).
13. Wipe o-pan and distributor funnels.
14. Inspect for loose/missing/bent/broken parts and hardware. Make note or repair as necessary.

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15. Remove all tools and supplies.
16. Climb out of the pit.
17. Install and latch curtain.
18. Install crow's nest side guard.
19. Remove lane barriers.
20. Remove LOTO.
21. Switch on both breakers.
22. Press TROUBLE CLEAR button.
23. Press HOME button.
24. Press CYCLE button.
25. Ensure full set is spotted and distributor is filling durabin in correct orientation.
26. Press MODE button to place pinspotter into standby mode.
27. Press EVEN/ODD button to move arrow to opposite pinspotter.
28. Press TROUBLE CLEAR button.

4.6.1.2. **Clean EDGE Lift**

1. At the system controller, select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Press MODE button to place pinspotter into mechanic mode.
3. Press SWEEP RUN button until sweep is at 1st guard position.
4. Switch off both breakers on system controller.
5. Implement Lockout/Tagout (LOTO).
6. Deploy lane barriers.
7. Remove the center guard from the Edge Lift.
8. Disengage and remove the carrier rails.
9. Using a shop towel, spray with a water base cleaner.
10. Wipe the Edge Lift inner and outer shells, Plows, Flight Cups, and Tabs. Spray additional water base cleaner on the Shop Towel as needed to keep damp. Replace with a clean Shop Towel as needed. To clean the area of the Edge Lift Chain assembly concealed by the o-pan, remove the Light Ball Sensor (LBS) guard.
11. Grab the corresponding pit conveyor drive belt just below the belt tensioner and pull downward.
12. This will rotate the Edge Lift in the normal direction. Continue rotating until the area of chain lift not yet cleaned is easily reached. "
13. Wipe this area with the shop towel dampened with a water based cleaner.
14. Using a clean shop towel, spray with a vinyl type dressing such as Armor-All. Wipe the Edge Lift inner and outer shells, Plows, Flight Cups, Tabs, and Carrier Rails. Spray additional Armor-All on the Shop Towel as needed to keep damp. Replace with clean Shop Towel(s) as needed."
15. To apply Armor-All to the area of the Edge Lift Chain assembly concealed by the O-pan, grab the corresponding pit conveyor drive belt just below the belt tensioner and pull downward. This will rotate the Edge Lift in normal direction. Continue rotating until area of chain lift not wiped with Armor-All is easily reached. Wipe this area with the shop towel dampened with Armor-All.

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16. Inspect for loose, missing, bent or broken parts and hardware. Make a note or repair as necessary.
17. Remove all tools and supplies.
18. Install the LBS guard.
19. Install the carrier rails - pointed end facing downward.
20. Install the center guard.
21. Remove lane barriers.
22. Remove LOTO.
23. Switch on both breakers.
24. At system controller press the white E-stop RESET button.
25. Press TROUBLE CLEAR button.
26. Press HOME button.
27. Press CYCLE button.
28. Ensure a full set of pins is spotted and the distributor is filling the durabin in correct orientation.
29. Press MODE button to place pinspotter into standby mode.

4.6.1.3. **Clean Durabin and Shuttle**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing toward that lane.
2. Press MODE button to place pinspotter into mechanic mode.
3. Press SWEEP RUN button until sweep is at 1st guard position.
4. Press TABLE RUN button until table is near respot height.
5. Switch off both breakers on system controller.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers on both lanes.
8. Remove/open the crow's nest front and side guards.
9. Unlatch the curtain and drape over the cushion weldment.
10. Climb into the pit.
11. Remove pins from the durabin pin pockets and place in the pit.
12. Using a shop towel, spray with a water base cleaner.
13. Wipe entire durabin and shuttle pin holders (as far as able to reach).
14. Using a clean shop towel, spray with a vinyl type dressing (Armor-All).
15. Wipe entire durabin and shuttle pin holders that have just been cleaned.
16. Climb out of the pit and step up onto the walk board.
17. Remove any remaining pins from the durabin, clean and apply vinyl type dressing as stated above.
18. Inspect for loose/missing/bent/broken parts and hardware. Make note or repair as necessary.
19. Remove all tools and supplies.
20. Install and latch curtain.
21. Install crow's nest front and side guard.
22. Remove lane barriers .
23. Remove LOTO.

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24. Switch on both breakers.
25. Press TROUBLE CLEAR button.
26. Press HOME button.
27. Press CYCLE button.
28. Ensure full set is spotted and distributor is filling durabin in correct orientation.
29. Press MODE button to place pinspotter into standby mode.
30. Press EVEN/ODD button to move arrow to opposite pinspotter.
31. Press TROUBLE CLEAR button.

4.6.1.4. **Clean PBL & Uprail Assembly**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing toward that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Run sweep to 1st guard position by pressing the SWEEP RUN button.
4. Press the EVEN/ODD button so arrow is pointing toward opposite lane.
5. Place pinspotter in mechanic mode by pressing MODE button.
6. Run sweep to 1st guard position by pressing the SWEEP RUN button.
7. Switch off breakers.
8. Implement Lockout/Tagout (LOTO).
9. Deploy lane barriers on both lanes.
10. Remove crow's nest side guard.
11. Release curtain latch and drape curtain over top of cushion.
12. Climb into the pit area of the pinspotter.
13. Using shop towels and a waterbased cleaner, wipe the PBL assembly and Uprail Track covers.
14. Vacuum between the sideplates under the PBL, LBS, and under the door rings
15. Check for loose/missing hardware, tighten/replace as required.
16. Check for worn or broken component. Correct if possible or note for future repair.
17. Exit the pit area.
18. Install and latch curtain.
19. Install crow's nest side guard.
20. Remove LOTO.
21. Switch on breakers.
22. Press TROUBLE CLEAR button.
23. Press HOME button.
24. Press MODE button to place pinspotter into standby mode.
25. Press EVEN/ODD button to move arrow to opposite pinspotter.
26. Press TROUBLE CLEAR button.
27. Press HOME button.
28. Press MODE button to place pinspotter into standby mode.

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4.6.1.6. **Clean Ball Door Exit, Lift Arm and LBS Paddle**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing toward that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Run sweep to 1st guard position by pressing the SWEEP RUN button.
4. Press the EVEN/ODD button so arrow is pointing toward opposite lane.
5. Place pinspotter in mechanic mode by pressing MODE button.
6. Run sweep to 1st guard position by pressing the SWEEP RUN button.
7. Switch off breakers.
8. Implement Lockout/Tagout (LOTO).
9. Deploy lane barriers on both lanes.
10. Remove crow's nest side guard.
11. Release curtain latch and drape curtain over top of cushion.
12. Climb into the pit area of the pinspotter.
13. Using shop towels and a water based cleaner, wipe the ball door exit rings, lift arm assembly and LBS paddle.
14. Check for loose or missing hardware. Tighten or replace as needed.
15. Lubricate as needed referring to the lubrication chart.
16. Climb from the pit area.
17. Install and latch curtain.
18. Remove lane barriers.
19. Remove LOTO.
20. Switch on breakers.
21. Press TROUBLE CLEAR button.
22. Press HOME button.
23. Press MODE button to place pinspotter into standby mode.
24. Press EVEN/ODD button to move arrow to opposite pinspotter.
25. Press TROUBLE CLEAR button.
26. Press HOME button.
27. Press MODE button to place pinspotter into standby mode.

4.6.1.7. **Service the Distributor Clutch Assembly**

Refer to the *EDGE Free Fall Distributor Manual* for information relating to this maintenance activity.

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4.6.2. **50,000 Frame Maintenance**

4.6.2.1. **Clean the Pit Conveyor Belt**

1. At the system controller, select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Press MODE button to place pinspotter into mechanic mode.
3. Press SWEEP RUN button until sweep is at 1st guard position.
4. Switch off both breakers on system controller.
5. Implement Lockout/Tagout (LOTO).
6. Deploy lane barriers.
7. Remove the center guard from the Edge Lift.
8. Remove distributor drive shaft from distributor.
9. Loosen the clamping bolt securing the LBS Guard to the system controller mount. Lift guard upward to release bottom. Set guard aside.
10. Using a water based cleaner, towel, scrub brush, and water (for rinsing) clean the section pit conveyor belt from under the cushion (as far as you can reach) to the Edge Lift plows.
11. Use a clean towel to wipe dry this section.
12. Grab the corresponding pit conveyor drive belt just above the LBS and pull upward. This will rotate the Edge Lift in reverse direction. Continue rotating until a new section of belt is located so that it can be cleaned.
13. Continue this procedure until the complete belt has been done.
14. Recommend that you allow the pit conveyor belt to air dry for a while before allowing anyone to bowl. (at least an hour).
15. Install the LBS guard by placing the top of the guard between the lip of the mounting bracket and the guard clamping bracket. Secure by tightening the clamping bolt.
16. Install the distributor drive shaft, securing it to the distributor with the pin and velcro assembly.
17. Install the center guard.
18. Remove lane barriers.
19. Remove LOTO.
20. Switch on both breakers.
21. At system controller press white E-Stop RESET button.
22. Press TROUBLE CLEAR button.
23. Press HOME button.
24. Press MODE button to place pinspotter into standby mode.

4.6.2.2. **Service the Table Assembly**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.

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5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Remove table motor power cord.
9. Crank table motor counterclockwise to lower table to the pin deck (spotting the pins). Hold down on the spotting arm latch while cranking motor.
10. Remove the bowling pins from the spotting cups.
11. Clean the spotting cups with a water-based cleaner.
12. Clean the table, respot cells, linkages, shifter mechanism, yoke, spot and respot rods, and leg supports with a cloth sprayed with WD-40.
13. Check for broken, worn, or loose parts or hardware. Tighten or replace as necessary.
14. Apply required lubrication following the lubrication schedule.
15. Connect table motor power cord.
16. Remove lane barriers.
17. Remove LOTO.
18. Switch on breakers.
19. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
20. Press the blue reset button located on the e-stop/reset button box located on the even lane handrail. The green LED indicator should light.
21. At the system controller press the white E-stop RESET button.
22. Press TROUBLE CLEAR button.
23. Press MODE button to place pinspotter into bowl/standby mode.
24. Press EVEN/ODD button to move arrow to opposite pinspotter.
25. Press HOME button.
26. Press CYCLE button. Check pin spotting and respotting for operational issues.
27. Make adjustments as necessary following the applicable procedures in the service section of this manual.
28. Press MODE button to place pinspotter into bowl/standby mode.

4.6.2.3. **Service the Sweep Assembly**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Remove the sweep motor power cable from the motor. The sweep will have to be cranked to various positions to allow access to all areas.
9. Wipe the sweep bar, links, and arms with a cloth sprayed with WD-40.
10. Inspect for broken, bent, worn, or loose parts or hardware. Tighten, repair, or replace as necessary.

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11. Visually inspect the corners of the sweep mounts for cracks. Replace if cracks are found.
12. Apply required lubrication following the lubrication schedule.
13. Connect sweep motor power cable.
14. Remove lane barriers.
15. Remove LOTO.
16. Switch on breakers.
17. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
18. Press the blue reset button located on the e-stop / reset button box. Located on the even lane handrail. The green LED indicator should light.
19. At the system controller press the white E-stop RESET button.
20. Press TROUBLE CLEAR button.
21. Press MODE button to place pinspotter into bowl/standby mode.
22. Press EVEN/ODD button to move arrow to opposite pinspotter.
23. Press HOME button.
24. Press CYCLE button. Check the sweep for operational issues.
25. Make adjustments as necessary following the applicable procedures in this service manual.
26. Press MODE button to place pinspotter into bowl/standby mode.

4.6.2.4. **Service the Cushion Assembly**

1. At system controller select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing towards that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Press EVEN/ODD button so arrow is pointing to other lane.
4. Press MODE button to put lane into mechanic mode.
5. Switch off breakers.
6. Implement Lockout/Tagout (LOTO).
7. Deploy lane barriers.
8. Remove the edge lift center guard.
9. Check for cracks or broken welds on the cushion weldment. Replace as necessary.
10. Check for broken, worn or missing rivets, replace as needed.
11. Check for torn curtain, replace as needed.
12. Check for bent curtain rod, worn or damaged rod bushing and rod hanger. Replace as necessary.
13. Check cushion plank for cracking. Replace as necessary.
14. Check for missing or loose hardware at the cushion tube weldment to cushion plank, Box support to kickback plate, and hanger ear to cushion tube weldment.
15. Check pad placement (should straddle cushion tube weldment upright - ball door side). Replace if ripped or missing.
16. Check cushion shock for leakage, replace as needed.
17. Check for missing/damaged cushion shock pins and clips.
18. Wipe side plates and all metal components associated with the cushion assembly with a dry shop towel.

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19. Install the edge lift center guard.
20. At the system controller, press the white E-stop RESET button.
21. Press TROUBLE CLEAR button.
22. Press MODE button to place pinspotter into bowl/standby mode.
23. Press EVEN/ODD button to move arrow to opposite pinspotter.
24. Press HOME button.
25. Press MODE button to place pinspotter into bowl/standby mode.

4.6.2.5. **Service the Shuttle Assembly**

1. At the system controller, select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing toward that lane.
2. Place pinspotter in mechanic mode by pressing MODE button.
3. Run sweep to 1st guard position by pressing the SWEEP RUN button.
4. Lower the table to respot height by pressing the TABLE RUN button.
5. Switch off breakers.
6. Perform Lockout/Tagout (LOTO)
7. Deploy lane barriers on both lanes.
8. Remove the crow's nest side guard.
9. Release curtain latch and drape curtain over top of cushion.
10. Climb into the pit area of the pinspotter.
11. Remove the pins from the durabin.
12. Remove the shuttle tension spring.
13. Remove the shuttle out of one of the slides on one side by loosening the two bolts and nuts holding the slide bracket to the rear frame of the durabin, and then pop the shuttle out of the slide. lower the shuttle, resting it on the table. This provides easier access to the hardware on the shuttle.
14. Check the pin Holders (cookies) for wear. Replace as needed.
15. Check for bent or broken shuttle straps. Replace as needed.
16. Check for bent tubes. Straighten or replace as needed.
17. Check for cracked or broken shuttle arm brackets. Replace as needed.
18. Check for loose or missing hardware. Tighten or replace as needed.
19. Place the shuttle in the slides, holding the slide bracket tight to the Shuttle, and tighten the bolts and nuts holding the slide bracket to the rear frame of the durabin.
20. Install the shuttle tension spring.
21. Climb out of the pit area.
22. Hang the curtain and latch.
23. Install the crow's nest side guard.
24. Remove the lane barriers.
25. Remove LOTO.
26. Switch on breakers.
27. Press TROUBLE CLEAR button.
28. Press HOME button.

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29. Press CONTINUOUS CYCLE button. Observe shuttle operation. If adjustment of shuttle rod is needed, refer to shuttle rod adjustment.
30. Press MODE button to place pinspotter into standby mode.
31. Press EVEN/ODD button to move arrow to opposite pinspotter.
32. Press TROUBLE CLEAR button.

4.6.2.6. **Service the Front End Motor (Table & Sweep) Brakes and Encoders**

Refer to the *EDGE Free Fall Motor & Gearbox Manual, 400-088-038-xx,* for information relating to this maintenance activity.

4.6.3. **100,000 Frame Maintenance**

4.6.3.1. **Home Disc Cleaning**

1. Implement Lockout/Tagout (LOTO).
2. Deploy lane barriers.
3. Do this procedure for both table and sweep home sensors.
    a. Crank motor until the home encoder disc slot is facing forward.
    b. With a shop towel, wipe the encoder disc including the slot.
    c. Remove the sensor cover and wipe both lenses of the sensor.
    d. Check both the encoder disc and sensor for any signs of wear, such as contact between the disc and sensor or between the disc and the sensor cover. Correct as needed.
    e. Crank the motor until the encoder disc is aligned with the sensor. The LED indicator on the sensor should light and go off as the slot passes by the sensor. If it doesn't, replacement of the sensor or cabling may be required.
    f. Replace the sensor cover.
4. Remove lane barriers.
5. Remove LOTO.
6. Place pinspotter into mechanic mode by pressing the MODE button.
7. Cycle pinspotter, check for correct operation.
8. Place pinspotter into standby mode by pressing the MODE button.

4.6.3.2. **Clean Machine Framework**

1. At the system controller select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Place the pinspotter in mechanic mode by pressing MODE button.
3. Clear the pins from the pin deck by pressing the SWEEP RUN button.
4. Press the HOME button.
5. Switch off both breakers.
6. Perform Lockout/Tagout (LOTO).
7. Deploy lane barriers on both lanes.

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8. Remove the crow's nest side guard.
9. Release curtain latch and drape curtain over top of cushion.
10. Climb into the pit area of the pinspotter.
11. Use a shop towel dampened with a water based cleaner and wipe down the front end frame assemblies, lower area of the crossbeam, and the table torque tube.
12. The table will need to lowered for access to frame assembly areas not reached from below by cranking the table motor.
13. Climb out of the pit area.
14. Hang the curtain and latch.
15. Install the crow's nest side guard.
16. Remove the lane barriers.
17. Remove LOTO.
18. Switch on breakers.
19. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
20. Press the blue RESET button located on the e-stop/reset button box located on the even lane handrail. The green LED indicator should light.
21. At the system controller press the white E-stop RESET button.
22. Press TROUBLE CLEAR button.
23. Press the TABLE RUN button until the table has completed one full cycle.
24. Press HOME button.
25. Press MODE button to place pinspotter into standby mode.

4.6.3.3. **Check all Machine Belts**

1. At system controller place pinspotter in mechanic mode by pressing MODE button.
2. Run sweep to 1st guard position by pressing the SWEEP RUN button.
3. Press the EVEN/ODD button so arrow is pointing toward opposite lane.
4. Place pinspotter in mechanic mode by pressing MODE button.
5. Run sweep to 1st guard position by pressing the SWEEP RUN button.
6. Switch off breakers.
7. Perform Lockout/Tagout (LOTO).
8. Deploy lane barriers on both lanes.
9. Loosen the clamping bolt securing the LBS Guard to the system controller mount. Lift guard upward to release bottom. Set guard aside.
10. Inspect both pit conveyor drive belts, ratchet drive belt, paddle drive upper and lower belts, both Edge Lift drive belts, and PBL belt, for any cracking, wearing or deterioration. Schedule for replacement as necessary.
11. While inspecting wipe the belts with a dry shop towel.
12. Install the LBS guard.
13. Remove the Edge Lift center guards from both Edge Lifts.
14. Inspect the distributor belts for wear, slickness on surface. Replace as needed.
15. Inspect the distributor belt laces and pin for damage and wear. Replace as needed.
16. Install the center guards.
17. Remove the lane barriers.

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18. Remove LOTO.
19. Switch on breakers.
20. At the system controller press the white E-stop RESET button.
21. Press TROUBLE CLEAR button.
22. Press HOME button.
23. Press MODE button to place pinspotter into standby mode.
24. Press EVEN/ODD button to move arrow to opposite pinspotter.
25. Press HOME button.
26. Press MODE button to place pinspotter into standby mode.

4.6.3.4. **Check & Tighten Front End Unistrut Jack Screw & Jam Nuts**

1. At the system controller select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Place the pinspotter in mechanic mode by pressing MODE button.
3. Clear the pins from the pin deck by pressing the SWEEP RUN button.
4. Press the HOME button.
5. Switch off both breakers.
6. Perform Lockout/Tagout LOTO).
7. Deploy lane barriers on both lanes.
8. Remove the crow's nest side guard.
9. Release curtain latch and drape curtain over top of cushion.
10. Climb into the pit area of the pinspotter.
11. Climb onto the pin deck to access the unistrut jackscrews.
12. Check the four Unistrut jackscrews for breakage and tightness. Replace and/or tighten as needed.
13. Check the jam nuts on the jackscrews for tightness. Tighten as needed.
14. Climb out of the pit area.
15. Hang the curtain and latch.
16. Install the crow's nest side guard.
17. Remove the lane barriers.
18. Remove LOTO.
19. Switch on breakers.
20. Press TROUBLE CLEAR button.
21. Press HOME button.
22. Press MODE button to place pinspotter into standby mode.

4.6.3.5. **Check for Missing Back End Jackscrew Locks**

1. At system controller place pinspotter in mechanic mode by pressing MODE button.
2. Run sweep to 1st guard position by pressing the SWEEP RUN button.
3. Press the EVEN/ODD button so arrow is pointing toward opposite lane.
4. Place pinspotter in mechanic mode by pressing MODE Button.
5. Run sweep to 1st guard position by pressing the SWEEP RUN button.
6. Switch off breakers.

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7. Perform Lockout/Tagout (LOTO).
8. Deploy lane barriers on both lanes.
9. Loosen the clamping bolt securing the LBS guard to the system controller mount. Lift guard upward to release bottom. Set guard aside.
10. Observe the two rear BE jackscrews located on the inside of the sideplates at the bottom rear. Ensure that the locking tabs are installed on the jackscrews.
11. If the locking tabs are missing, check that the jackscrews are in contact with the flooring. If not tighten jackscrew until they contact the floor.
12. Install the locking tab.
13. Install the LBS guard.
14. Remove the crow's nest side guard.
15. Release curtain latch and drape curtain over top of cushion.
16. Climb into the pit area of the pinspotter.
17. Observe the two front BE jackscrews located on the outside of the sideplates at bottom front. Access is thru the openings in the sideplates. Ensure that the locking tabs are installed.
18. If the locking tabs are missing, check that the jackscrews are in contact with the flooring. If not tighten jackscrew until they contact the floor.
19. Install the locking tab.
20. Climb out of the pit area.
21. Hang the curtain and latch.
22. Install the crow's nest side guard.
23. Remove the lane barriers.
24. Remove LOTO.
25. Switch on breakers.
26. At the system controller press the white E-stop RESET button.
27. Press TROUBLE CLEAR button.
28. Press HOME button.
29. Press MODE button to place pinspotter into standby mode.
30. Press EVEN/ODD button to move arrow to opposite pinspotter.
31. Press HOME button.
32. Press MODE button to place pinspotter into standby mode.

4.6.3.6. **Check the Alignment of the Spot/Respot Cams and Levers**

1. At the system controller, select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Place the pinspotter in mechanic mode by pressing MODE button.
3. Clear the pins from the pin deck by pressing the SWEEP RUN button.
4. Press the HOME button.
5. Switch off both breakers.
6. Perform Lockout/Tagout (LOTO).
7. Deploy lane barriers on both lanes.
8. Place a couple of blocks of wood (2x4) on the pin deck to support the table.
9. Disconnect the sweep motor's power cable.

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10. Crank the sweep to 1st guard position.
11. Disconnect the table motor's power cable.
12. Crank the table motor while engaging the spot solenoid by holding the plunger up until the table is resting fully on the blocks of wood.
13. Visually observe the alignment of the spot/respot cam to the cam followers of the spot and respot levers.
14. Visually observe the alignment of the shuttle cam to the cam follower of the shuttle lever.
15. If all three are out of alignment in the same direction and distance, then the table shaft will need to be moved to correct the alignment.
16. If all three are out of alignment in opposite directions, then the spot/respot cam and the shuttle cam will need to be moved to correct the alignment.
17. If only the spot/respot cam is out of alignment with the cam followers, then the spot/respot cam will need to be moved along the table shaft.
18. If only the shuttle cam is out of alignment with the cam follower, then the shuttle cam needs to be moved along the table shaft.
19. To move the table shaft; loosen the bearing locking collar, that secures the table shaft to the 3 flanged bearing, by loosening the setscrew holding the collar to the shaft, and using a punch and hammer at the hole, rotating the collar counterclockwise until loose.
20. Carefully move the table drive shaft until the spot/respot cam and shuttle cam are in alignment with their respective cam followers. A hammer and wooden block can be used to tap the table shaft into position.
21. Tighten the bearing locking collar by rotating the collar clockwise using a punch and hammer at the hole. Tighten the locking collar setscrew.
22. Check the alignment of table drive clevis, centered between the forks of the torque tube. Adjust if necessary.
23. To align only the spot/respot cam or the shuttle cam, loosen the socket head bolts/nuts securing the hub cap to the cams.
24. Tap the cam with a hammer to align with its respective cam follower.
25. Tighten the socket head bolts/nuts to secure the cam to the table shaft.
26. Crank the table so that the block of wood can be removed.
27. Connect the table and sweep power cords to the motors.
28. Remove the lane barriers.
29. Remove LOTO.
30. Switch on breakers.
31. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
32. Press the BLUE RESET button located on the e-stop/reset button box, located on the even lane handrail. The green LED indicator should light.
33. At the system controller, press the white E-stop RESET button.
34. Press TROUBLE CLEAR button.
35. Press HOME button.
36. Press TABLE RUN button until the table has completed one cycle.
37. Press HOME button.

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38. Press CYCLE button and observe for correct operation.
39. Press MODE button to place pinspotter into standby mode.

4.6.3.7. **Sweep Home Disc Adjustments**

1. Press the MODE button to place pinspotter into mechanic mode.
2. Cycle the pinspotter one complete cycle.
3. Press the MODE button to place pinspotter into standby mode.
4. Implement Lockout/Tagout (LOTO). On SmartGuard™-equipped pinspotters, it is necessary to use the Home and Encoder Tester (088-001-635) in order to get the LED to turn on with the safety system disconnect open.
5. Deploy lane barriers.
6. Crank the sweep motor until the home disc indicating LED is on.
7. Visually observe the location of the sweep motor tie rod assembly in relation to the sweep crank arm and sweep drive shaft. The sweep motor tie rod assembly should bisect the sweep crank arm and sweep drive shaft (see figure at right). If not, crank the sweep motor until the sweep motor tie rod assembly bisects the sweep crank arm and sweep drive shaft.

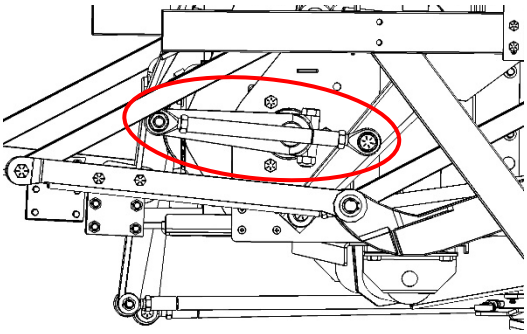

Figure 4.6-1

8. Loosen the setscrew holding the home sensor disc to the sweep drive shaft.
9. Rotate the home sensor disc on the sweep drive shaft until the home sensor LED comes on, keeping the disc centered in the slot of the home sensor guard.
10. Hold the home encoder disc so that it is centered in the slot of the sensor guard and tighten the setscrew securely the sweep drive shaft.
11. Remove lane barriers.
12. Remove LOTO.
13. Climb into the even lane crow's nest and check that no one is within the mask to the front of the pinspotter area for the pair.
14. Press the blue RESET button on the e-stop/reset button box located on the even lane handrail. The green indicator LED should light.
15. At the system controller, press the white e-stop RESET button.
16. Press TROUBLE CLEAR button.
17. The system controller guard settings will have to be adjusted if the home encoder disc location was moved.
18. Place pinspotter into mechanic mode by pressing MODE button.
19. Cycle pinspotter and check for correct operation.
20. Press MODE button to place pinspotter into standby mode.

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4.6.3.8. **Table Home Disc Adjustments**

1. Press the MODE button to place pinspotter into mechanic mode.
2. Cycle the pinspotter one complete spotting cycle so machine is on 1st ball.
3. Press the MODE button to place pinspotter into standby mode.
4. Implement Lockout/Tagout (LOTO). On SmartGuard™-equipped pinspotters, it is necessary to use the Home and Encoder Tester (088-001-635) in order to get the LED to turn on with the safety system disconnect open.
5. Deploy lane barriers.
6. Check that the table home sensor LED is on. If not, crank the table motor until the table home sensor LED comes on.
7. There should be a gap of approximately ½ inch between the table drive eccentric's white nylon roller and the rear edge of the cam link as viewed from above. If not, crank the table motor until you obtain the ½ inch between the table drive eccentric's white nylon roller and the rear edge of the cam link.
8. Loosen the setscrew holding the home sensor disc to the table drive shaft.
9. Hold the home encoder disc so that it is centered in the slot of the sensor guard and tighten the setscrew securely the sweep drive shaft.
10. Remove lane barriers.
11. Remove LOTO.
12. Climb into the even lane crow's nest and check that no one is within the mask to the front of the pinspotter area for the pair.
13. Press the blue RESET button on the e-stop/reset button box located on the even lane handrail. The green indicator LED should light.
14. At the system controller, press the white e-stop RESET button.
15. Press TROUBLE CLEAR button.
16. The system controller guard settings will have to be adjusted if the home encoder disc location was moved.
17. Place pinspotter into mechanic mode by pressing MODE button.
18. Cycle pinspotter and check for correct operation.
19. Press MODE button to place pinspotter into standby mode.

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4.6.3.9. **Check Light Ball Sensor Operation**

Refer to the *Positive Ball Lift Manual* for information relating to this maintenance activity.

4.6.3.10. **Clean the Distributor Assembly**

Refer to the *EDGE Free Fall Distributor Manual* for information relating to this maintenance activity.

4.6.3.11. **Service the Distributor Drive Shaft Assembly**

Refer to the *EDGE Free Fall Distributor Manual* for information relating to this maintenance activity.

4.6.3.12. **Service the EDGE Performance Lift Check and Tighten Hardware**

Refer to the *EDGE Performance Lift Manual* for information relating to this maintenance activity.

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4.6.3.13. **Service the Cushion Shock Assembly**

1. At the System Controller select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Place the pinspotter in Mechanic Mode by pressing MODE button.
3. Run the sweep to the 1st guard position.
4. Switch off both breakers.
5. Perform Lockout/Tagout (LOTO).
6. Deploy lane barriers on both lanes.
7. Remove the center guard from the edge lift.
8. Remove the cushion shock assembly from the cushion assembly by removing the clevis pin and pushing the pin out of the hanger ear, shock grommet, and the cushion tube weldment.
9. To ease the removal of the pin, loosen the nuts and bolts attaching the hanger ear to the cushion tube weldment.
10. Remove the cushion shock assembly from the motor mount weldment by removing the clevis pin and pushing the pin out of the motor mount weldment and cushion shock assembly grommet.
11. Check the grommets and bushings for damage or excessive wear. Replace as needed.
12. Lubricate the bushing and grommet using brake fluid only.
13. Remove the compression spring from the shock assembly by loosening the bolt holding the collar.
14. Slide the collar, spring, and spring seating washer off the shock.
15. Clamp the shock end only (not the piston housing) in a vise. Press the piston rod into the housing, checking for binds and/or little-to-no resistance. Replace as needed.
16. Check the piston housing for dents or leaking fluid. Replace as needed.
17. Install the compression spring, collar, and spring seating washer.
18. Insert a 1/2-inch open-end wrench between the coils of the spring at the point where the piston rod exits the piston housing so that the wrench jaws straddle the piston rod.
19. Hold the wrench against the piston housing while turning the spring. When the length of the spring is 6¼ inches, slide the collar against the spring, tighten the collar's lock screw, and remove the wrench.
20. Install the cushion shock assembly on the motor mount weldment by inserting the retaining pin through the holes in the motor mount weldment and the cushion shock assembly.
21. Place the large washer on the clevis pin before installing the bow-tie pin.
22. Attach the cushion shock assembly to the cushion tube weldment by inserting the clevis pin through the holes in the cushion tube weldment, the cushion shock assembly, and the hanger ear. Replace large washer and bow-tie pin.
23. To ease retaining pin installation, loosen the nuts and bolts attaching the hanger ear to the cushion tube weldment. Tighten the hanger ear nuts and bolts after the shock is in place.
24. Install the Center Guard.
25. Remove Lane Barriers

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26. Remove Lockout/Tagout.
27. Switch on both Breakers.
28. Press Trouble Clear button.
29. Press Home button.
30. Press the Mode button to place pinspotter into Standby Mode.

4.6.3.14. **Service the Downsweep and Transition Track**

1. At the system controller place the pinspotter in mechanic mode by pressing MODE button.
2. Run sweep to 1st guard position by pressing the SWEEP RUN button.
3. Press the EVEN/ODD button so the arrow is pointing toward the opposite lane.
4. Press MODE button to place pinspotter into mechanic mode
5. Run sweep to 1st guard position by pressing the SWEEP RUN button.
6. Switch off both breakers.
7. Perform Lockout/Tagout (LOTO).
8. Deploy lane barriers on both lanes.
9. Open the crow's nest front guard.
10. Remove the Positive Ball Lift (PBL) guard. Set it aside.
11. Remove the ball wiper cloth by removing the wiper cloth rings from wiper supports. Set it aside.
12. Remove the dust trap by unsnapping the retaining straps around the wiper supports. Set it aside.
13. Clean the downsweep weldment and transition track with a cloth dampened with a water-based cleaner.
14. Check the downsweep weldment and transition track for broken parts. Replace/repair as needed.
15. Check that the downsweep is centered between the pinspotter frames. Correct as needed.
16. Check for loose, worn, or missing hardware on the downsweep weldment, transition track, and the track support brackets. Tighten or replace as needed.
17. Inspect for cracks or broken parts of the downsweep weldment, transition track, and the track support brackets.
18. Install the ball wiper cloth and dust trap.
19. Install the PBL guard.
20. Install crow's nest front guard.
21. Remove lane barriers.
22. Remove LOTO.
23. At the system controller switch on breakers.
24. Press TROUBLE CLEAR button.
25. Press HOME button.
26. Press MODE button to place pinspotter into standby mode.
27. Press the EVEN/ODD button so the arrow is pointing toward the opposite lane.
28. Press TROUBLE CLEAR button.
29. Press HOME button.

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30. Press MODE button to place pinspotter into standby mode.

4.6.4. **200,000 Frame Maintenance**

4.6.4.1. **Service the Sweep Gearbox – Change the Gearbox Oil**

Refer to the *EDGE Free Fall Motor & Gearbox Manual,* for information relating to this maintenance activity.

4.6.4.2. **Service the Table Gearbox – Change the Gearbox Oil**

Refer to the *EDGE Free Fall Motor & Gearbox Manual,* for information relating to this maintenance activity.

4.6.4.3. **Service the EDGE Performance Lift Track & Chain Assembly**

Refer to the *EDGE Performance Lift Manual* for information relating to this maintenance activity.

4.6.4.4. **Service the Pit Conveyor Rollers and Pit Assembly**

1. At the system controller select place the pinspotter in mechanic mode by pressing MODE button.
2. Run sweep thru to sweep the pins from the pin deck by pressing the SWEEP RUN button and allow the durabin to fill.
3. Run sweep to 1st guard position by pressing the SWEEP RUN button.
4. Press the EVEN/ODD button so the arrow is pointing toward the opposite lane.
5. Press MODE button to place pinspotter into Mechanic Mode
6. Run sweep to 1st guard position by pressing the SWEEP RUN button.
7. Switch off both breakers.
8. Perform Lockout/Tagout (LOTO).
9. Deploy lane barriers on both lanes.
10. Loosen the clamping bolt securing the Light Ball Sensor (LBS) guard to the system controller mount. Lift guard upward to release bottom. Set guard aside.
11. Remove the EDGE Performance Lift.
12. Remove the paddle from the rudder arm by loosening and removing the 3/8 -16 nut, bolt and two washers.
13. Remove the cushion shock assembly by removing the bow tie pin, washer, and clevis pins - both top and bottom. Loosening the nuts and bolts securing the cushion ear will help with removal. Set cushion shock assembly aside.
14. Release the curtain latch and allow the curtain to lay in the pit.
15. Remove the cushion assembly by loosening and removing the three bolts securing the cushion support box to the ball door side plate. Drape curtain over the cushion support tube and remove the cushion assembly out the rear of the pinspotter and set aside.
16. Loosen the square head bolts securing the pit conveyor pulley to the shaft of the rear roller.

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17. Disconnect the pit conveyor drive belt from the pit conveyor pulley and remove the pulley from the rear roller.
18. Release the front roller from its bearing supports by inserting the carpet Installing tool or a pry bar between the front roller and the tail plank. Apply pressure toward the rear of the pinspotter. When the bearing support bracket clears the hole in the kickback plate, insert a carpet pin (792-501-001) or a 1/4-20 x 3/4" bolt into the hole.
19. Remove the front roller by rolling it over the bounce board and out the ball exit opening into the adjacent pinspotter.
20. Remove the anti-Idling bracket assembly by loosening and removing the 5/16-18 stover nuts securing it to the ball door exit side plate. Work the anti-idling bracket out from between the pit conveyor belt.
21. Remove the rear roller by unhooking the rear roller support from its bracket. Tip the rear roller from its bearing support; then, pass it into the adjacent pinspotter through the access hole in the side plate opposite the ball exit side.
22. If the pit conveyor belt does not need to be replaced, mark the direction of rotation on the belt.
23. Remove the bounce board assembly and conveyor belt by removing the 4 nuts and washers that secure the vibration dampeners to the studs on the pit support brackets. Fold the pit conveyor belt onto the bounce board assembly and lift the bounce board off the studs and out of the back of the pinspotter.
24. Sweep or vacuum the area beneath the area previously covered by the bounce board assembly.
25. Check for loose, worn, or missing hardware. Tighten or replace as needed.
26. Release the spring tension on the front bearing supports using the carpet tool and flag, remove the carpet pins or 1/4-20 bolts and allow the front bearing supports to rotate forward. Use a spring puller to remove the spring from the stud on the side plate.
27. Remove the snap rings with snap ring pliers and slide the bearing supports and washers off the pivot studs. Clean the studs and bearing supports.
28. Check the studs for wear. Replace as needed.
29. Check the bearing support bushings. Replace as needed.
30. Check the condition of the rubber support and the metal "ears" that hold the rubber in place. Replace as needed.
31. Lubricate the pivot studs and bearing support bushings with oil.
32. Install the bearing supports and washers and retain with the snap rings.
33. Attach the springs to the stud on the side plate using a spring puller. With the carpet tool and flag, rotate the front bearing supports until a carpet pin (792-501-001) or a 1/4-20 x 3/4" bolt can be inserted into the hole in the side plate to hold the front bearing support under tension.
34. Check the rubber supports, support retainer, and the support weldment that hold the rear roller in place for excessive wear. Replace as needed.
35. Check the pit support brackets for worn or broken studs or cracking. Replace as needed.
36. Check the condition of the kickback fiber panels and rivets. Replace as needed.
37. Remove the pit conveyor belt from the bounce board assembly.

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38. Check the bounce boards for cracks and excessively worn or damaged areas. Replace as needed.
39. Check the support channels and angle support for cracks or broken areas. Replace as needed.
40. Check the vibration dampeners for deformity or cracks and rips in the rubber. Replace as needed.
41. Check that the bonding strap is in good condition. Replace as needed.
42. Remove any belt fabric from the bearing area on the front and rear rollers.
43. Check the condition of the bearings on the front and rear rollers. Replace as needed.
44. Check for excessive play in the front roller assembly halves, or if the front roller was knocking during operation, replace or rebuild the front roller.
45. Install the pit conveyor belt onto the bounce board assembly. The arrow on the pit conveyor belt must point in the direction of belt rotation.
46. Wrap the pit conveyor belt around the bounce plate assembly and place it in the pit on the pit support brackets. Place the free end of the bonding strap over the stud of the pit support bracket and install the washers and 5/16-inch lock nuts onto the studs at each corner of the bounce plate assembly. Tighten securely. Make sure that the pit conveyor belt is free and not pinched between the bounce board and the brackets.
47. Install the rear roller by passing it from the adjacent pinspotter on the side opposite the ball exit side of the pinspotter, through the opening in the rear of the kickback plates, and through the pit conveyor belt. Place the rear roller bearings in the bearing supports and hook the handle of the rear roller support weldment under the retaining tab on the kickback plate.
48. Install the anti-Idling assembly to the side plate and secure with 5/16-18 stover nuts.
49. Install the pit conveyor drive pulley and align the square head bolts with the flat section of the rear roller shaft and securely tighten the bolts.
50. Install the pit conveyor drive belt.
51. Install the front roller into the pinspotter by passing it through the ball exit opening of the adjacent pinspotter and into the pit conveyor belt on top of the bounce board.
52. Install the front roller in the bearing supports by grasping the end of the roller assembly on the top only and roll it into the support assembly. Repeat for the other end of the roller. Make sure that the roller bearings are fully seated in the bearing supports. Remove the carpet pins (792-501-001) or a 1/4-20 x 3/4" bolts holding the bearing support brackets by inserting the carpet installing tool or a pry bar between the front roller and the tail plank and applying pressure toward the rear of the pinspotter to allow removal of the pins or bolts.
53. Install the paddle on the rudder arm securing with the 3/8-16 nut and bolt. Place a washer under the bolt head and nut.
54. Install the cushion assembly reversing the steps above.
55. Install the EDGE Performance Lift.
56. Install the LBS guard.
57. Remove lane barriers.
58. Remove LOTO.
59. At the system controller, switch on breakers.

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60. Press TROUBLE CLEAR button.
61. Press HOME button.
62. Press MODE button to place pinspotter into standby mode.
63. Press the EVEN/ODD button so the arrow is pointing toward the opposite lane.
64. Press TROUBLE CLEAR button.
65. Press HOME button.
66. Press MODE button to place pinspotter into standby mode.

Depending on the type of pit conveyor belt installed (if new), a break-in period may be required.

4.6.5. **500,000 Frame Maintenance**

4.6.5.1. **Service the Positive Ball Lift Assembly**

Refer to the *Positive Ball Lift (PBL) Manual* for information relating to this maintenance activity.

4.6.5.2. **Service the Back End Motor & Gearbox**

Refer to the *EDGE Free Fall Motor & Gearbox Manual* for information relating to this maintenance activity.

4.6.5.3. **Service the Light Ball Sensor (LBS) Assembly**

Refer to the *Positive Ball Lift Manual* for information relating to this maintenance activity.

4.6.5.4. **Service the Distributor Assembly**

Refer to the *EDGE Free Fall Distributor Manual* for information relating to this maintenance activity.

4.6.5.5. **Service the Sweep Motor & Gearbox – Coupling & Output Shaft Inspection**

Refer to the *EDGE Free Fall Motor & Gearbox Manual,* for information relating to this maintenance activity.

4.6.5.6. **Service the Table Motor & Gearbox – Coupling & Output Shaft Inspection**

Refer to the *EDGE Free Fall Motor & Gearbox Manual,* for information relating to this maintenance activity.

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4.6.5.7. **Service the Table Drive**

1. At the system controller select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Place the pinspotter in mechanic mode by pressing MODE button.
3. Sweep the pins into the pit. Press the HOME button to return the sweep to its home (up) position.
4. Run the sweep to the 1st guard position.
5. Switch off both breakers.
6. Perform Lockout/Tagout (LOTO).
7. Deploy lane barriers on both lanes.
8. Disconnect the table motors power cable.
9. Place a couple of 2x4s on the pin deck to support the table.
10. Crank the table down, while engaging the spotting arm latch onto the spotting arm link, so that the table rests on the 2x4s. The table must be supported to allow the bolt to be removed from the clevis.
11. Remove the nut and bolt securing the clevis to the table torque tube. Set the bearing and spacers aside. Try to keep the clevis from turning on the rod end to prevent having to adjust the table height during reassembly.
12. Loosen the nut and bolt clamping the table drive assembly to the table drive shaft.
13. Remove the table drive assembly from the table drive shaft (be careful of the key).
14. Remove the clevis rod end from the table eccentric drive.
15. Check the clevis for wear. Replace as needed.
16. Check the clevis rod end bearings for excessive play or binding. Replace as needed.
17. Remove the latch arm assembly, link actuator assembly, and latch assembly by removing their corresponding roll pins and shafts from the table drive housing.
18. Check the bushings in the table drive housing and the latch assembly sleeve for excessive play. Replace as needed.
19. Check all of the actuating mechanism for loose or worn parts. Replace as needed.
20. Remove the locking nut from the bolt that is securing the table drive eccentric to the table drive housing.
21. Remove the table drive eccentric from the housing.
22. Clean all the grease from the roller bearings.
23. Check that the roller bearings rotate freely. If not replace.
24. Apply a liberal amount of new grease to the roller bearings and inside the housing.
25. Attach the table drive eccentric to the table drive housing with the bolt. Tighten the bolt completely and then back off 1/3 turn.
26. Install the locknut on the bolt, tightening the nut with a socket while holding the bolt with a wrench.
27. Reassemble all components of the table drive assembly including the clevis and rod end.
28. Install the table drive assembly onto the table drive shaft, centering the clevis between the torque tube arm forks where the clevis sits, and tighten the nut and bolt to 100ft/lbs that secures the table drive assembly to the table drive shaft.

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29. Check the bearing that supports the torque tube for excessive play or wear. Replace as needed.
30. Install the bolt and nut that secures the clevis to the torque tube, capturing the bearing and spacers, tighten the nut and bolt securely.
31. Crank the table up slightly and remove the 2x4s.
32. Connect the tables motors power cable.
33. Remove the lane barriers.
34. Remove LOTO.
35. Switch on breakers.
36. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
37. Press the blue RESET button located on the e-stop/reset button box located on the even lane handrail. The green LED indicator should light.
38. At the system controller, press the white E-stop RESET button.
39. Press TROUBLE CLEAR button.
40. Press the TABLE RUN Button, letting the table complete one full cycle.
41. Press HOME button.
42. Press CYCLE button and observe for correct operation.
43. If pins spot incorrectly, fall over, or if the table is contacting the pin deck, then table adjustments are needed.
44. Press the MODE button to place pinspotter into standby mode.

4.6.5.8. **Service the Shuttle Rod Assembly**

1. At the system controller select the pinspotter to be serviced by pressing the EVEN/ODD button so the arrow is pointing toward that lane.
2. Place the pinspotter in mechanic mode by pressing MODE button.
3. Run the sweep to the 1st Guard position.
4. Switch off both breakers.
5. Perform Lockout/Tagout (LOTO).
6. Deploy lane barriers on both lanes.
7. Remove/open the crow’s nest front and side guards.
8. Release curtain latch and drape curtain over top of cushion.
9. Climb into the pit area of the pinspotter.
10. Remove the pins from the durabin.
11. Remove the shuttle tension spring.
12. Climb out of the pit and step up onto walk board.
13. Remove the nuts and bolts that secure the shuttle rod assembly to the shuttle operating rod lever and the front end lever assembly of the shuttle actuator, and remove the shuttle rod assembly from the pinspotter.
14. At the workbench - Insert a pin punch in the hole in the larger diameter tube of the shuttle rod assembly. The pin punch must pass thru the hole of the inner rod and out the other side of the large tube. The inner rod can be turned to align the holes with a locking-type pliers or another pin punch in the hole in the smaller diameter tube of the shuttle rod assembly.

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15. With the pin punch inserted, place the large diameter tube in a vise, clamping on the large tube.
16. Using locking-type pliers clamped to the smaller diameter tube, rotate the smaller diameter tube in a counterclockwise direction and unscrew the small tube until it separates from the inner rod.
17. Remove the washers and spring from the shuttle rod assembly.
18. Check the washers and spring for excessive wear. Replace as needed.
19. Remove the pin punch from the large tube.
20. Adjust the large tube in the vise so that the large nut (where the rod end attaches) can be loosened and removed.
21. Remove the large nut and then remove the inner rod from the large tube.
22. Clean all parts with a cloth dampened with a water-based cleaner.
23. Check for excessive wear on the inner rod. Replace as needed.
24. Check the rod ends for excessive wear. Replace as needed.
25. Apply a liberal amount of grease inside the large tube where the inner rod goes.
26. Assemble the shuttle rod assembly by reversing the steps above inserting the inner rod through the large diameter tube, the through washer, the spring, and the stepped washer. Apply Loctite® 242 or 243 to the threads of the inner rod, and thread it into the smaller diameter tube. Torque to 30-35 ft-lbs (40-47 Nm). Complete the assembly by installing the large nut and rod ends.
27. Install and tighten the nut and bolt to secure the shuttle rod assembly to the shuttle operating rod lever.
28. Climb onto the pinspotter walk board. Install and tighten the nut and bolt to secure the shuttle rod assembly to the shuttle operating rod lever.
29. Install and tighten the nut and bolt securing the shuttle rod assembly to the front end lever assembly of the shuttle actuator.
30. Climb from the walkboard onto the tread plate, then climb into the pit area of the pinspotter.
31. Attach the shuttle spring to the rear of the shuttle.
32. Check the shuttle road adjustment, should be 2" from the front of the rear shuttle tube to the durabin frame. Adjust if needed.
33. Install and latch curtain.
34. Install/close crow's nest front and side guard.
35. Remove lane barriers .
36. Remove LOTO.
37. Switch on both breakers.
38. Press TROUBLE CLEAR button.
39. Press HOME button.
40. Press CONTINUOUS CYCLE button and observe for correct operation. Make any needed adjustments.
41. *Make adjustments if shuttle malfunctions are occurring, i.e. double shuttling or a pin is not shuttling. Adjustment procedure - For double shuttling: Lengthen shuttle rod until one pin does not shuttle, then shorten shuttle rod by 1 to 2 turns of the rod end. For a pin not shuttling, shorten the shuttle rod by 1 to 2 turns of the rod end.*

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42. Press CONTINUOUS CYCLE button to stop the operation.
43. Press MODE button to place pinspotter into standby mode.

4.6.5.9. **Service the Shifter and Cam Link Needle Bearings**

1. At system controller, select pinspotter to be serviced by pressing the EVEN/ODD button so arrow is pointing toward that lane.
2. Place pinspotter in mechanic ode by pressing MODE button.
3. Run the sweep to knock the pins into the pit pressing the SWEEP RUN button. Press the HOME button to return the sweep to its home position.
4. Switch off breakers.
5. Perform Lockout/Tagout (LOTO).
6. Deploy lane barriers on both lanes.
7. Disconnect the tables motors power cable.
8. Crank the table down while engaging the spotting arm latch onto the spotting arm link to allow the table to go to pin spotting height.
9. Loosen the jam nuts on both rod ends of the short rod assembly that connects the cam link to the actuator lever weldment.
10. Turn the rod of the short rod assembly to remove the pressure of the cam link against the cam follower.
11. Remove the nut and bolt that secures the short rod assembly to the actuator lever weldment.
12. Remove the two nuts and bolts that secure the cam link to the shifter link assembly. Set the spacer aside.
13. Remove the cam link and shifter link assembly from the shaft.
14. Wipe away excess grease from shaft, cam link, and shifter link assembly.
15. Inspect the shaft for excessive wear. Replace as needed. To remove the shaft, loosen the set screw and push the shaft from the tie rod bracket.
16. Install the shaft, if removed, into the tie rod bracket, but do not tighten the set screw at this time.
17. Inspect the needle bearings in the cam link and shifter link assembly for wear. Replace as needed.
18. Apply a liberal amount of grease to the needle bearings.
19. Install the cam link and shifter link assembly on to the shaft of the tie rod bracket.
20. Install the spacer and the two nuts and bolts to secure the cam link and shifter link assembly. Tighten securely.
21. Tighten the set screw to secure the shaft to the tie rod assembly.
22. Install and tighten the nut and bolt that secures the short rod assembly to the actuator lever weldment.
23. Turn the rod of the short rod assembly so that the cam link applies pressure against the cam follower. Finger tight only.
24. Tighten the jam nuts on both rod ends of the short rod assembly.
25. Connect the table motors power cable.
26. Remove the lane barriers.
27. Remove LOTO.

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28. Switch on breakers.
29. Climb into the even lane crow's nest and check that no one is within the mask to the front of pinspotter area for the pair.
30. Press the blue RESET button located on the e-stop/reset button box. Located on the even lane handrail. The green LED indicator should light.
31. At the system controller press the white E-stop RESET button.
32. Press TROUBLE CLEAR button.
33. Press the TABLE RUN Button, letting the table complete one full cycle.
34. Press HOME button.
35. Press CYCLE button and observe for correct operation.
36. Press the MODE button to place pinspotter into standby mode.

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Section 4C TROUBLESHOOTING

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Table of Contents

Section 4 C TROUBLESHOOTING....4-115
4.7 Troubleshooting....4-119
4.7.1. Troubleshooting Tools....4-119
4.7.1.1. Digital Multimeter....4-119
4.7.1.2. Voltage Tester....4-119
4.7.2. Table Troubleshooting....4-120
4.7.2.1. PROBLEM: Respot cells will not pick up or release pins....4-120
4.7.2.2. PROBLEM: Scoring or Pindication Problems (miscounts, no strike cycle, etc.)....4-121
4.7.2.3. PROBLEM: Table runs continuously....4-122
4.7.2.4. PROBLEM: Table stops before zero position....4-123
4.7.2.5. PROBLEM: 1st ball - sweep moves down to the guard position, and the table continues to run....4-124
4.7.2.6. PROBLEM: 1st ball - sweep starts toward pit, table starts up with pins in fingers, both stop, neither will run....4-125
4.7.2.7. PROBLEM: Pin fell over during spotting....4-126
4.7.2.8. PROBLEM: 2nd Ball or Strike – Table runs but does not shuttle pins or go all the way down to the spotting position....4-127
4.7.3. Sweep Troubleshooting....4-128
4.7.3.1. PROBLEM: Sweep overruns all stopping positions. Motor coasts....4-128
4.7.3.2. PROBLEM: Sweep error/motor trips overload....4-129
4.7.3.4. PROBLEM: Sweep hits gutter at 1st guard position....4-130
4.7.3.5. PROBLEM: Sweep runs continuously....4-131
4.7.3.6. PROBLEM: Sweep arm hits frame of machine at zero. position....4-132
4.7.3.7. PROBLEM: 1st ball – table comes down and picks up standing pins, but does not respot them. Sweep remains at guard position....4-133
4.7.3.8. PROBLEM: 1st ball - table comes down on top of an off spot pin, thus not picking up the pins. Then the sweep clears the pin deck. Table comes down to respot height, then table and sweep return to home....4-134
4.7.3.9. PROBLEM: 2nd ball or strike – table does not run, bins loaded with pins but will not drop the pins into the spotting cups....4-135
4.7.3.10. PROBLEM: Sweep runs too far into pit area....4-136
4.7.3.11. PROBLEM: Sweep does not knock all pins into pit....4-136
4.7.4. Cushion and Pit Troubleshooting....4-137

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4.7.4.1. PROBLEM: Ball idles at cushion. 4-137
4.7.4.2. PROBLEM: Ball idles at exit – will not enter lift. 4-138
4.7.4.3. PROBLEM: Ball failed to cycle pinspotter. 4-139
4.7.4.4. PROBLEM: Pinspotter continues to cycle or cycles randomly. 4-140
4.7.4.5. PROBLEM: Back end overload error and/or motor trips on overload. 4-141
4.7.5. System Controller Troubleshooting 4-142
4.7.5.1. PROBLEM: Table time delay too long or too short. 4-142
4.7.5.2. PROBLEM: Sweep time delay too long or too short. 4-143
4.7.5.3. PROBLEM: Cannot turn pinspotter on from the MCU. 4-144
4.7.5.4. PROBLEM: Scoring chassis scores correctly on first ball but does not score on second ball. Second ball signal is not getting to chassis. 4-145
4.7.5.5. PROBLEM: Scoring chassis is not scoring the first ball, but scores correctly on the second ball. Receiving second ball signal continuously. 4-145
4.7.6. Motor Troubleshooting 4-146
4.7.6.1. PROBLEM: Front end motor will not run. 4-146
4.7.7. Centerpunch Deck Lighting Troubleshooting (when not connected to Effects Server) 4-148
4.7.7.1. PROBLEM: Centerpunch Deck Lighting will not turn on. 4-148

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4.7 Troubleshooting

4.7.1. Troubleshooting Tools

4.7.1.1. Digital Multimeter

Figure 4.7-1 - Digital Multimeter

CAUTION **Using a multimeter on live circuits can expose the user to hazarous voltage and could lead to property damage/loss, personal injury, and/or death.**

1. **Open Circuits**
   A. To check the continuity of any wire, disconnect one end of the wire.
   B. Set multimeter to Continuity/Audio check (see figure 4.7-2).
   C. Connect one side of the tester to one end of the suspect wire, and the other side of the tester to the end of the disconnected wire.
   D. If the wire is good, the meter should read near zero and/or buzz. If the wire is open, the meter will not react.
2. **Shorts**
   A. To check for a short between two wires, disconnect both ends of the suspect wires.
   B. Set multimeter to Continuity/Audio check (see figure 4.7-2).
   C. Connect the meter to one end of each wire. If meter reads near zero and/or buzzes, the wires are shorted. If meter does not react, the wires are not shorted.
3. **Grounds**
   A. To check for a ground, disconnect both ends of the suspect wire.
   B. Set multimeter to Continuity/Audio check (see figure 4.7-2).
   C. Connect one side of the tester to the machine's frame (bare metal) or to a ground lug and the other side of the tester to one end of the wire being tested.
   D. If the wire is grounded, the meter read near zero/buzz. If the wire is not grounded, the meter will not react.

Figure 4.7-2 - Continuity Check

4.7.1.2. Voltage Tester

CAUTION **For use on alternating or direct current (AC or DC). All power to the component to be tested should be turned on. Caution should be used when testing live circuits.**

Figure 4.7-3 - AC Setting

A. To check for AC voltage, set the meter for AC and select the range between 200 and 600 VAC (see figure 4.7-3). Connect the tester across the hot leads (line) on the device to be tested. B. To check for DC voltage, set the meter for DC and select the range bewteen 200mV and 600VDC (see figure 4.7-4).

Figure 4.7-4 - DC Setting

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4.7.2. **Table Troubleshooting**

4.7.2.1. **PROBLEM: Respot cells will not pick up or release pins.**

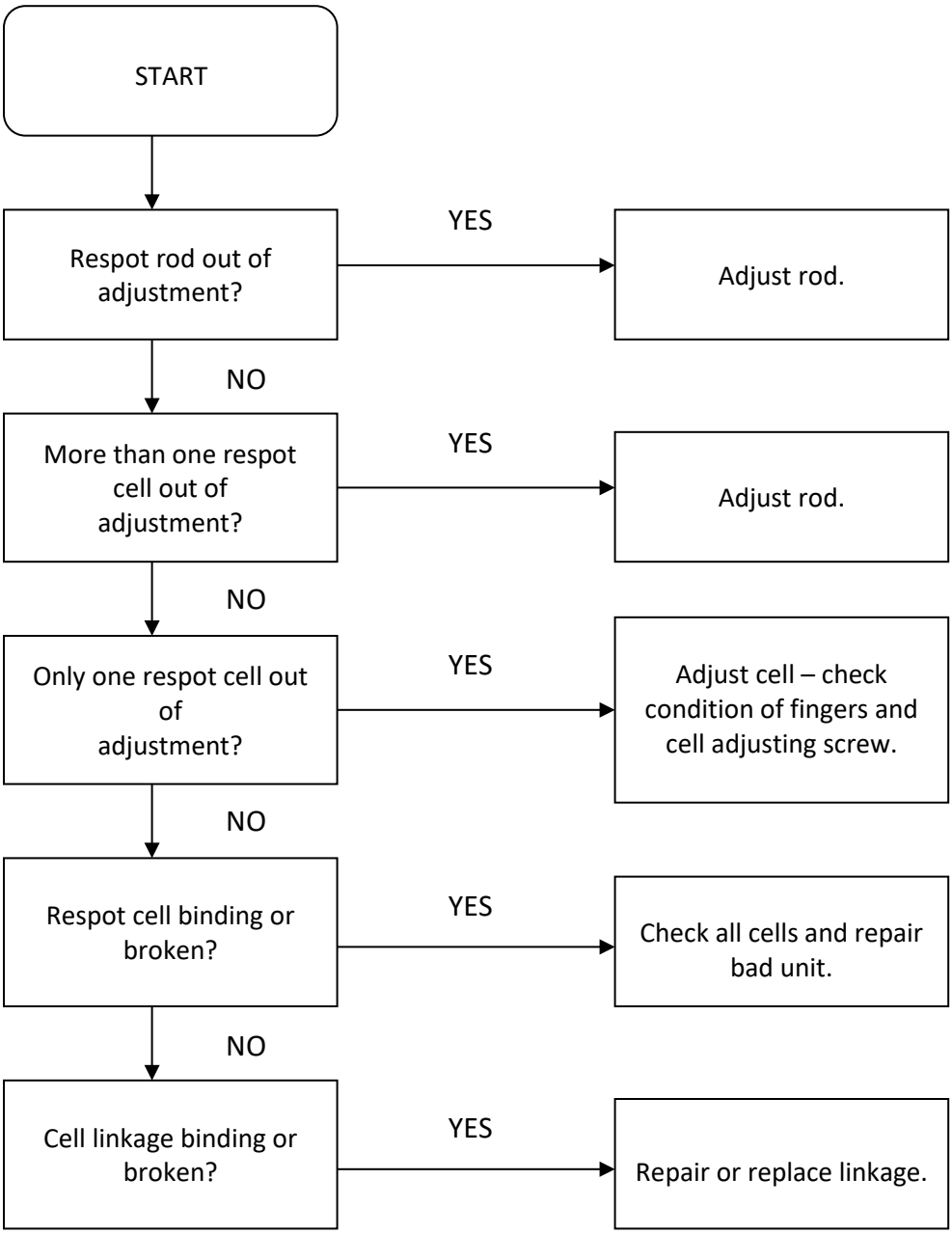

Figure 4.7-5

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4.7.2.2. **PROBLEM: Scoring or Pindication Problems (miscounts, no strike cycle, etc.)**

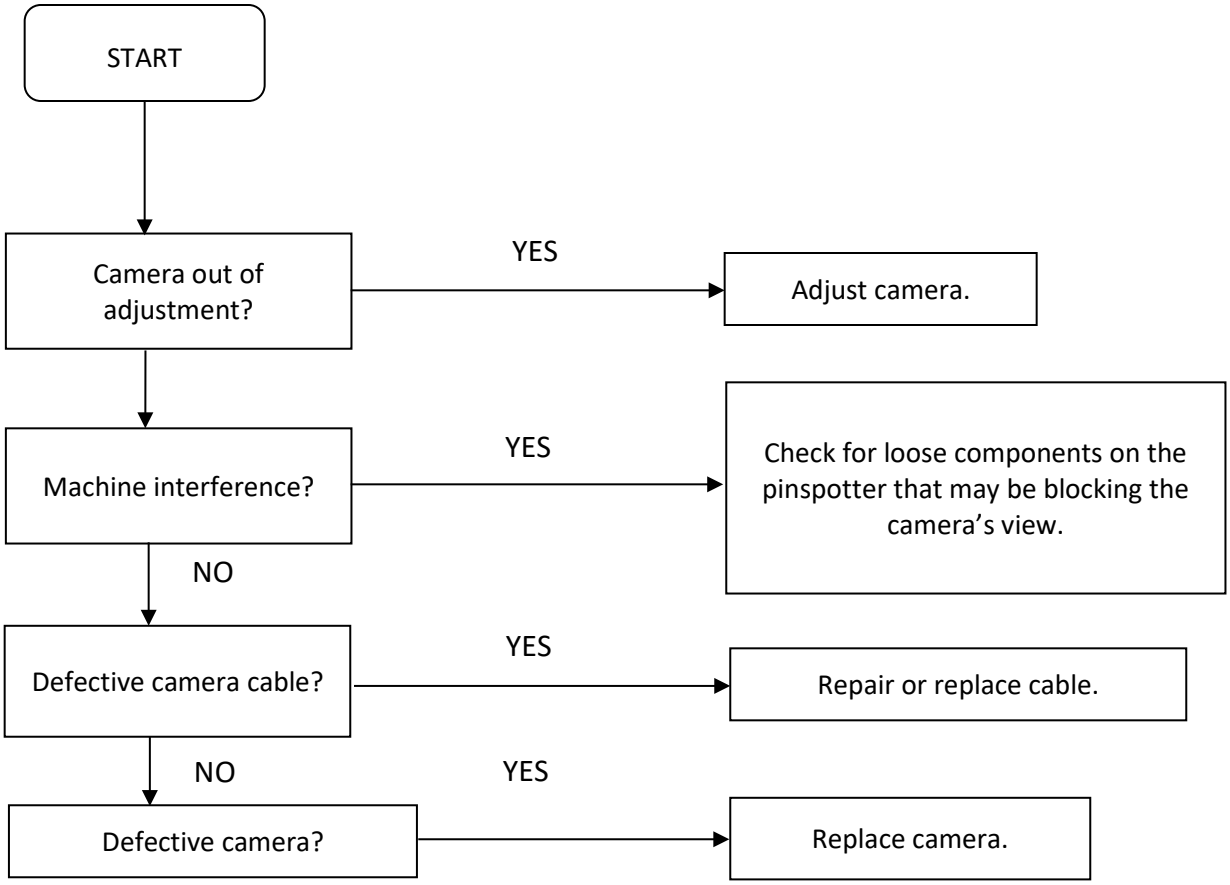

Figure 4.7-6

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4.7.2.3. **PROBLEM: Table runs continuously.**

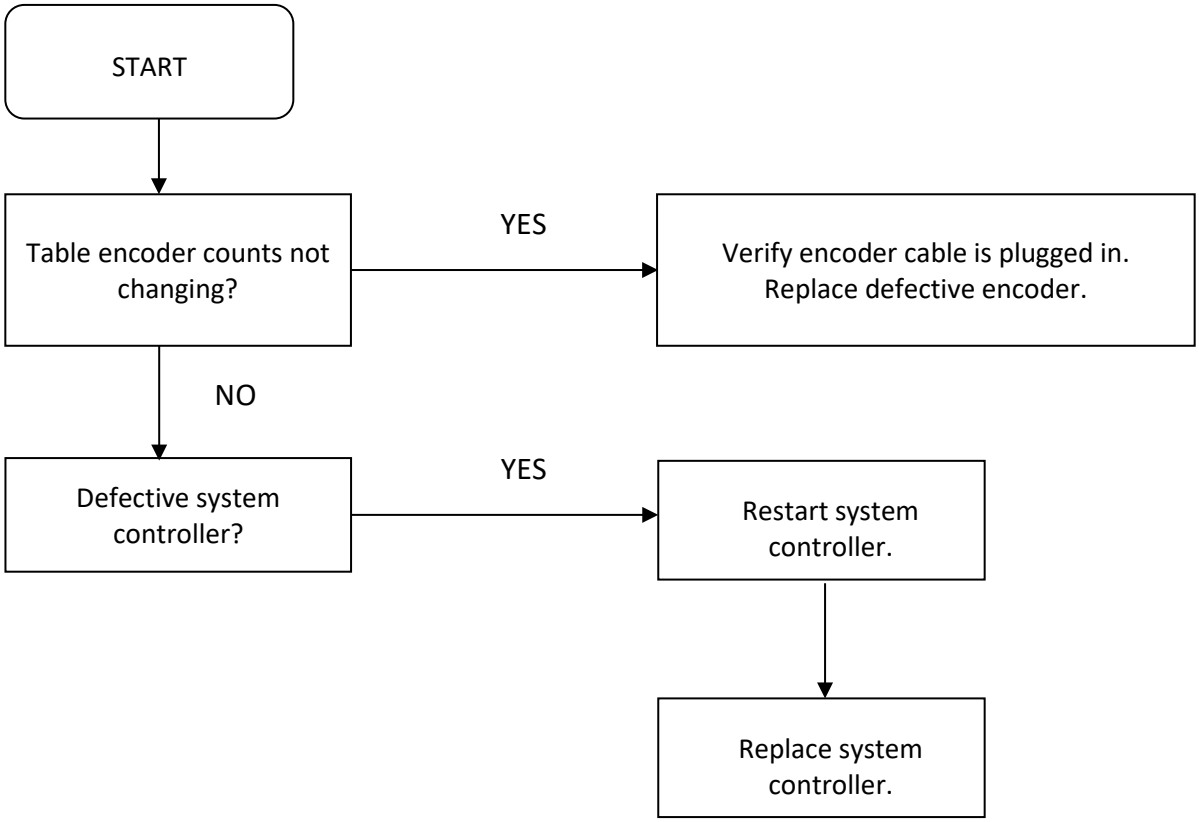

Figure 4.7-7

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4.7.2.4. **PROBLEM: Table stops before zero position.**

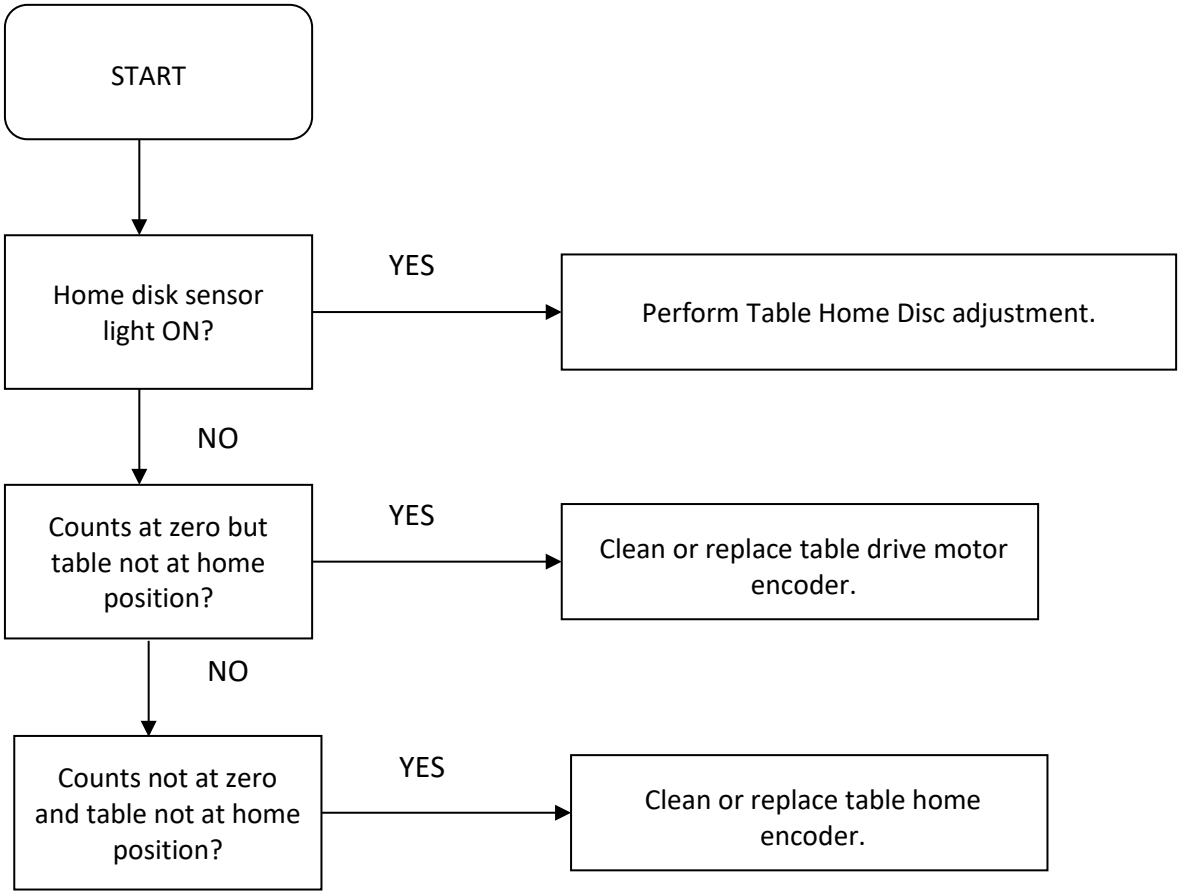

Figure 4.7-8

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4.7.2.5. PROBLEM: 1st ball - sweep moves down to the guard position, and the table continues to run.

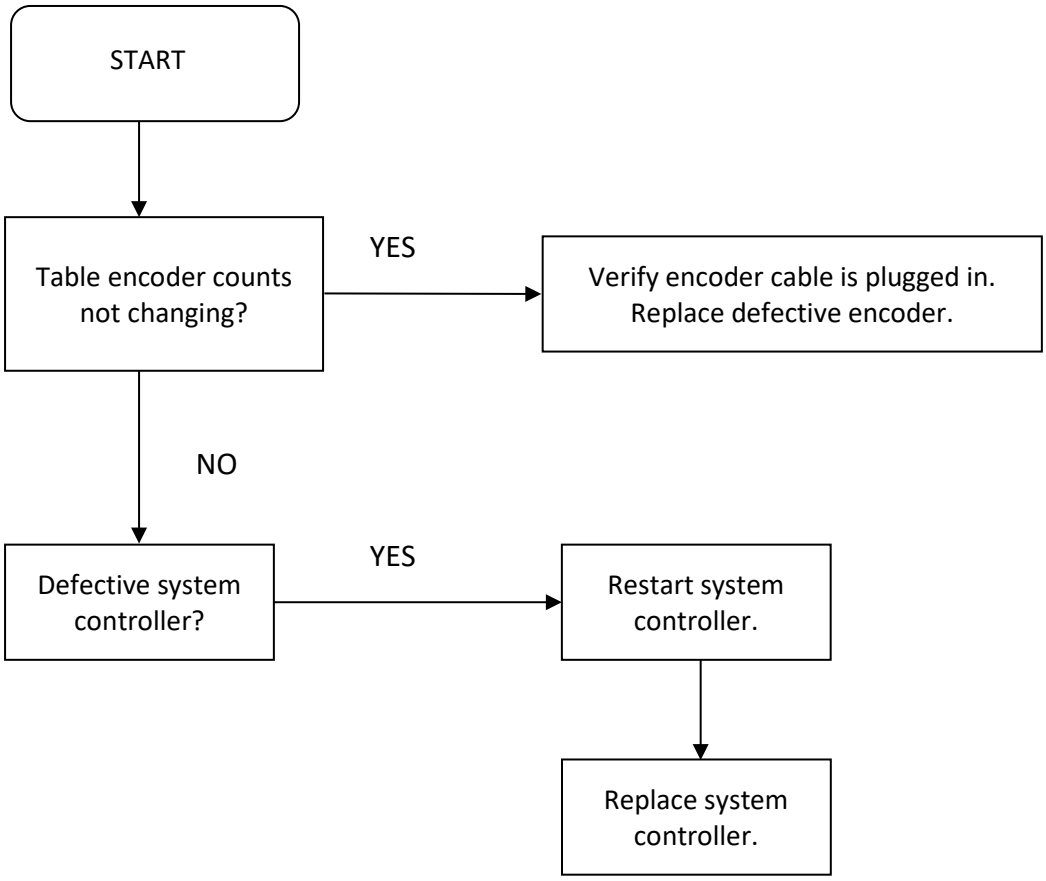

Figure 4.7-9

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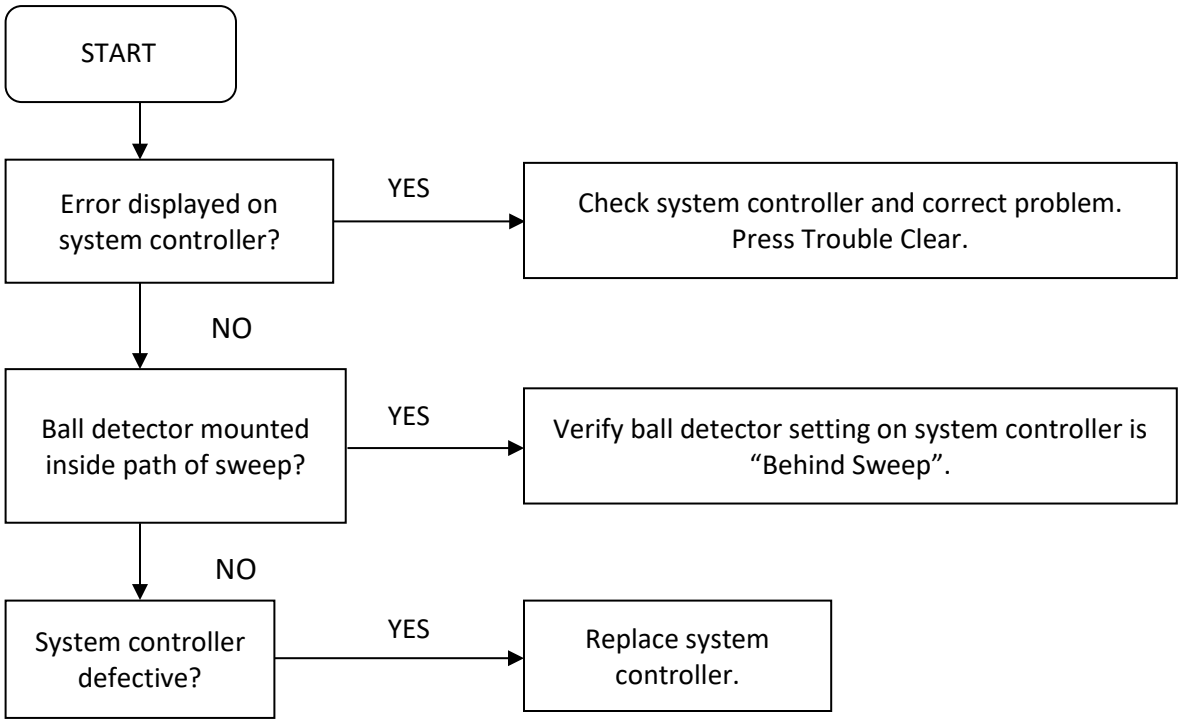
4.7.2.6. **PROBLEM: 1st ball - sweep starts toward pit, table starts up with pins in fingers, both stop, neither will run.**



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4.7.2.7. **PROBLEM: Pin fell over during spotting.**

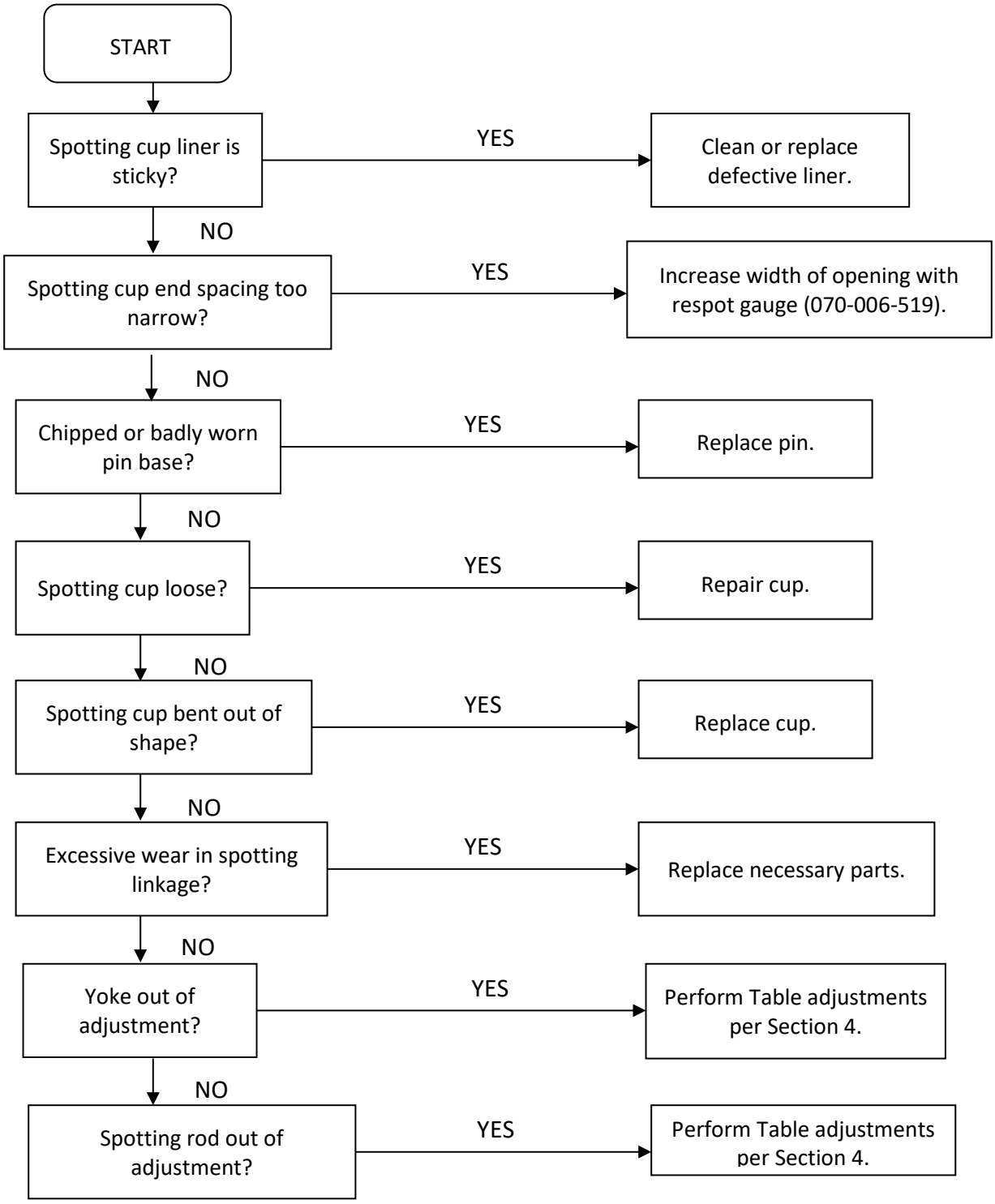

Figure 4.7-11

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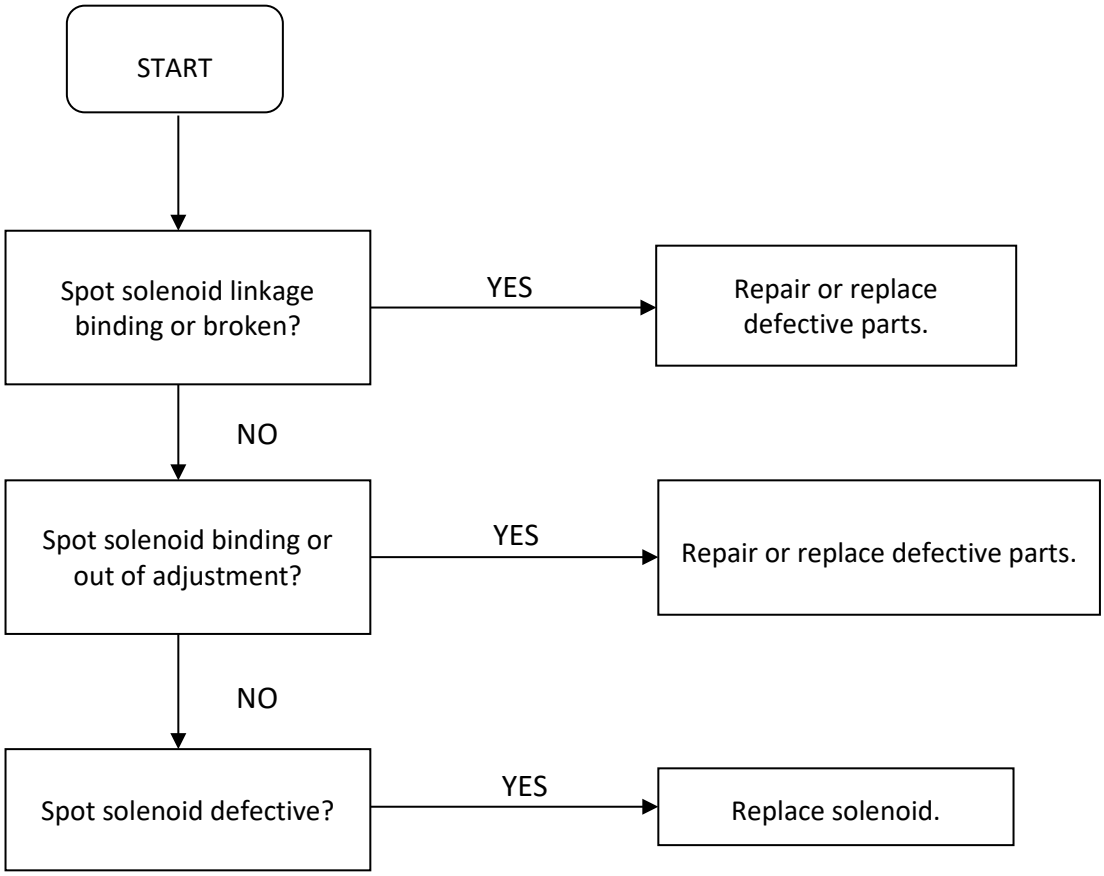
4.7.2.9. **PROBLEM: 2nd Ball or Strike – Table runs but does not shuttle pins or go all the way down to the spotting position.**



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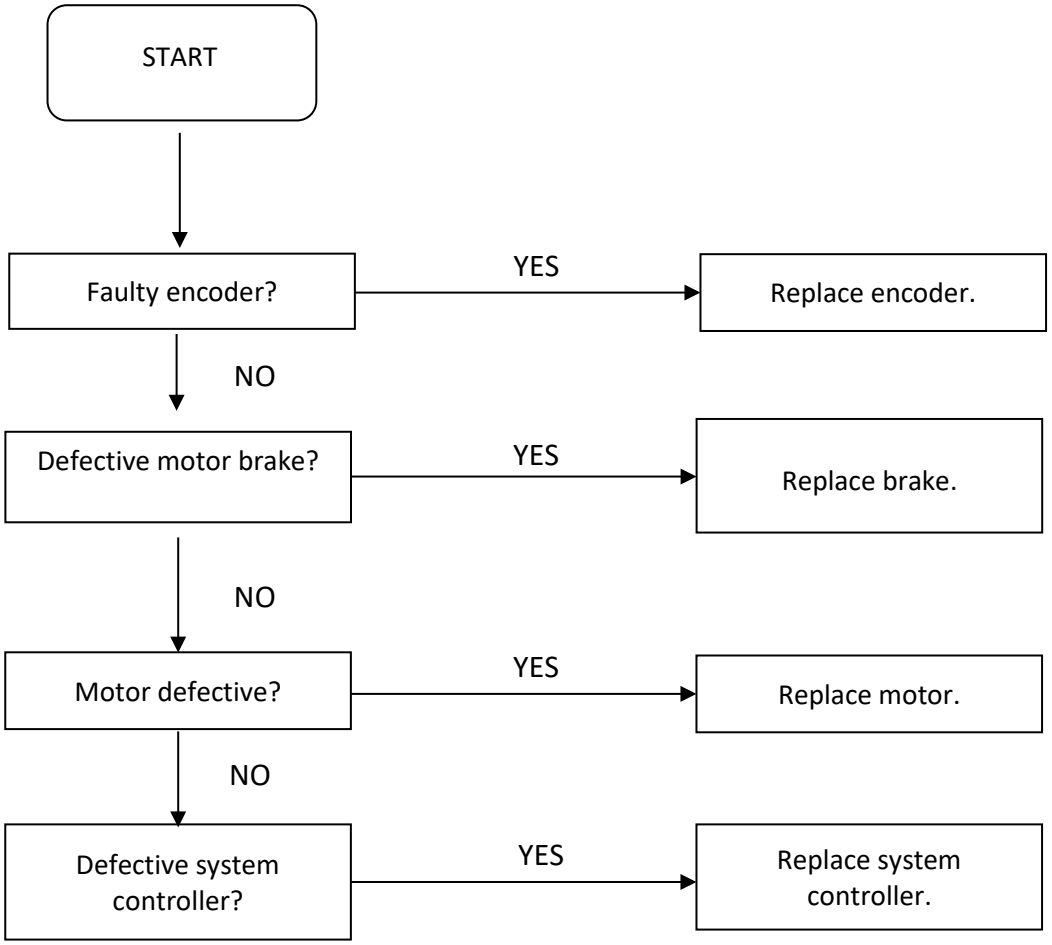
4.7.3. **Sweep Troubleshooting**

4.7.3.1. **PROBLEM: Sweep overruns all stopping positions. Motor coasts.**



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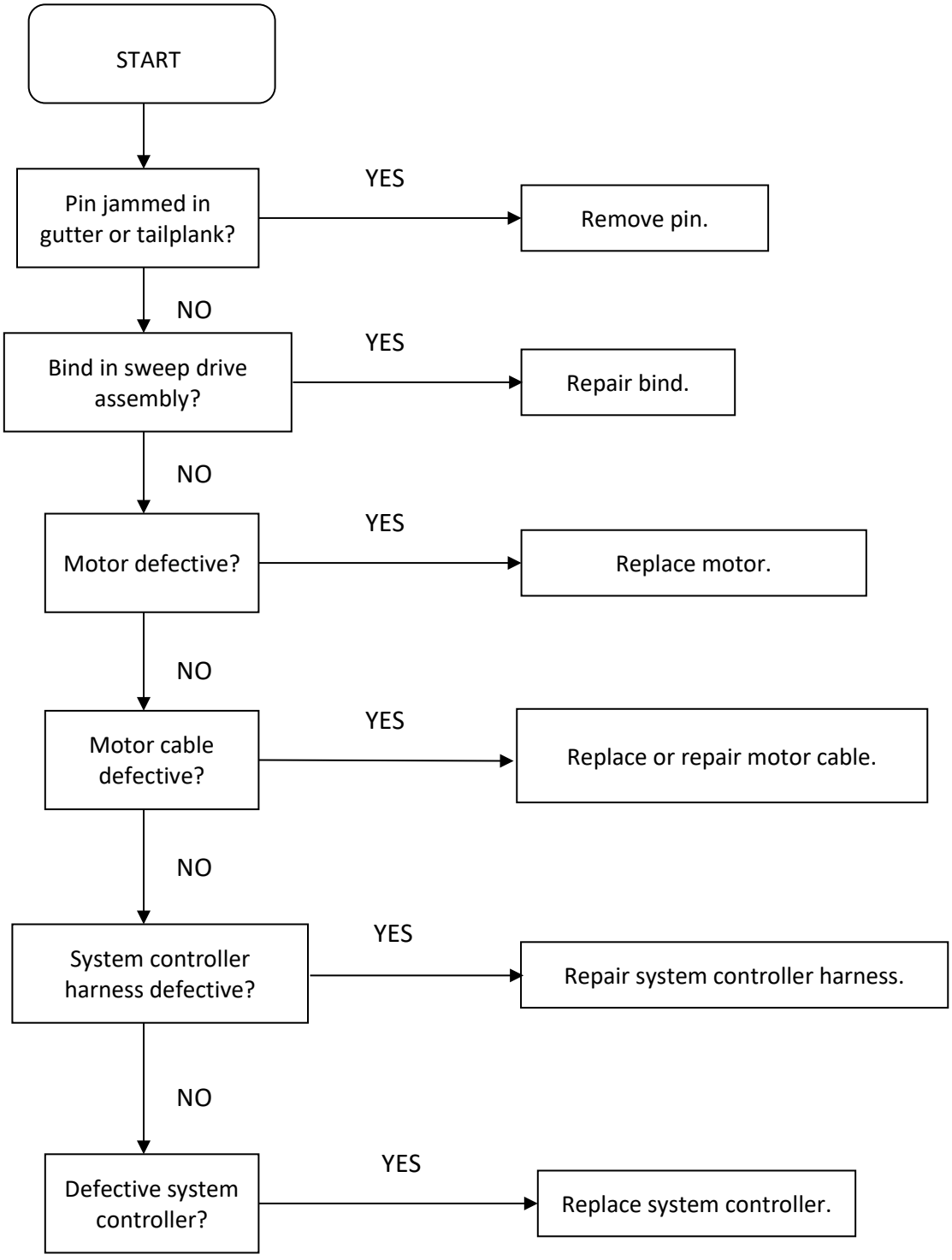
4.7.3.2. **PROBLEM: Sweep error/motor trips overload.**



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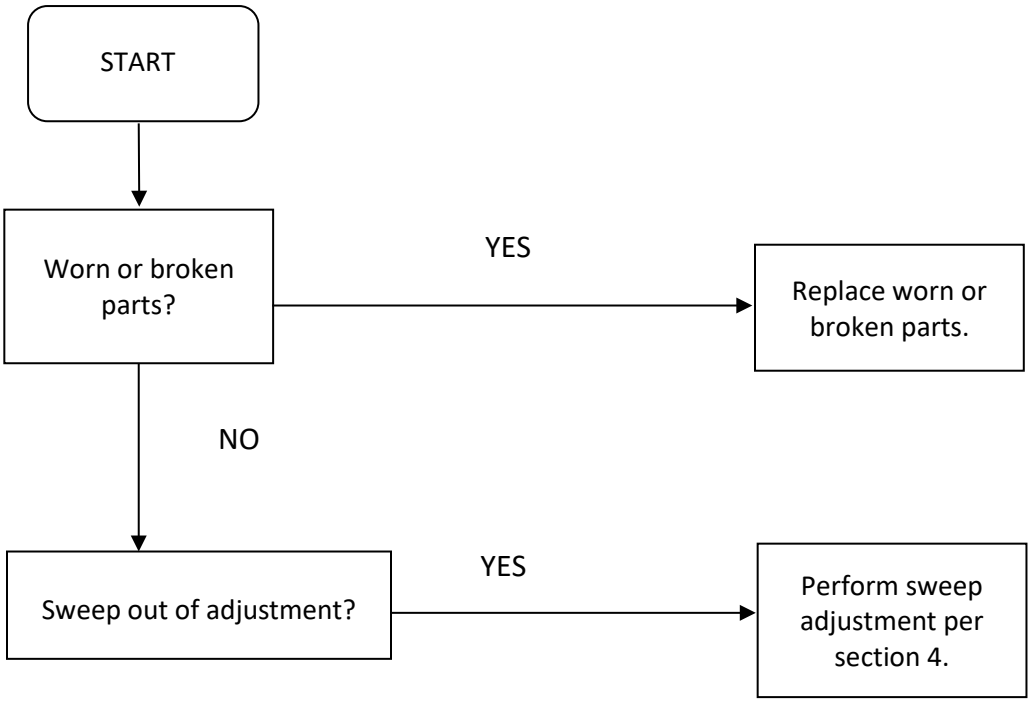
4.7.3.4. **PROBLEM: Sweep hits gutter at 1st guard position.**



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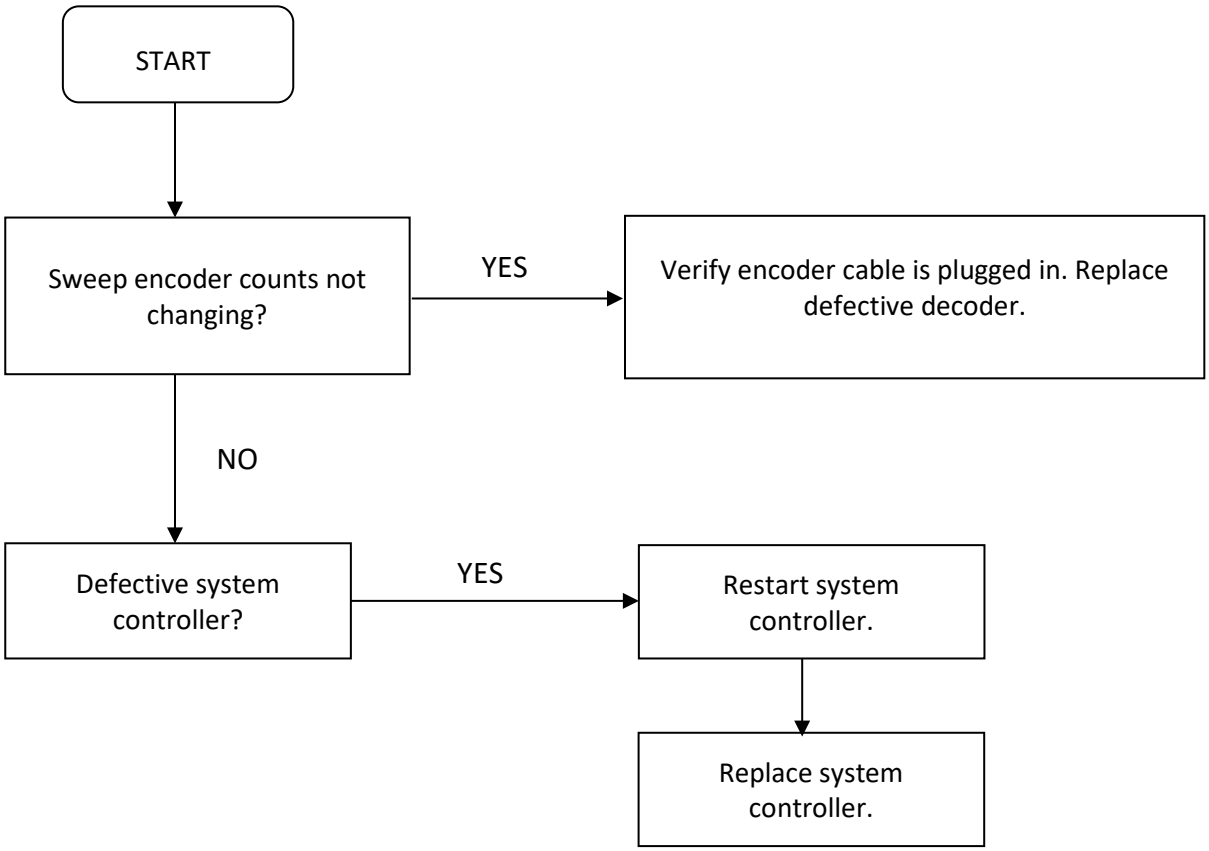
4.7.3.5. **PROBLEM: Sweep runs continuously.**



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4.7.3.6. **PROBLEM: Sweep arm hits frame of machine at zero. position.**

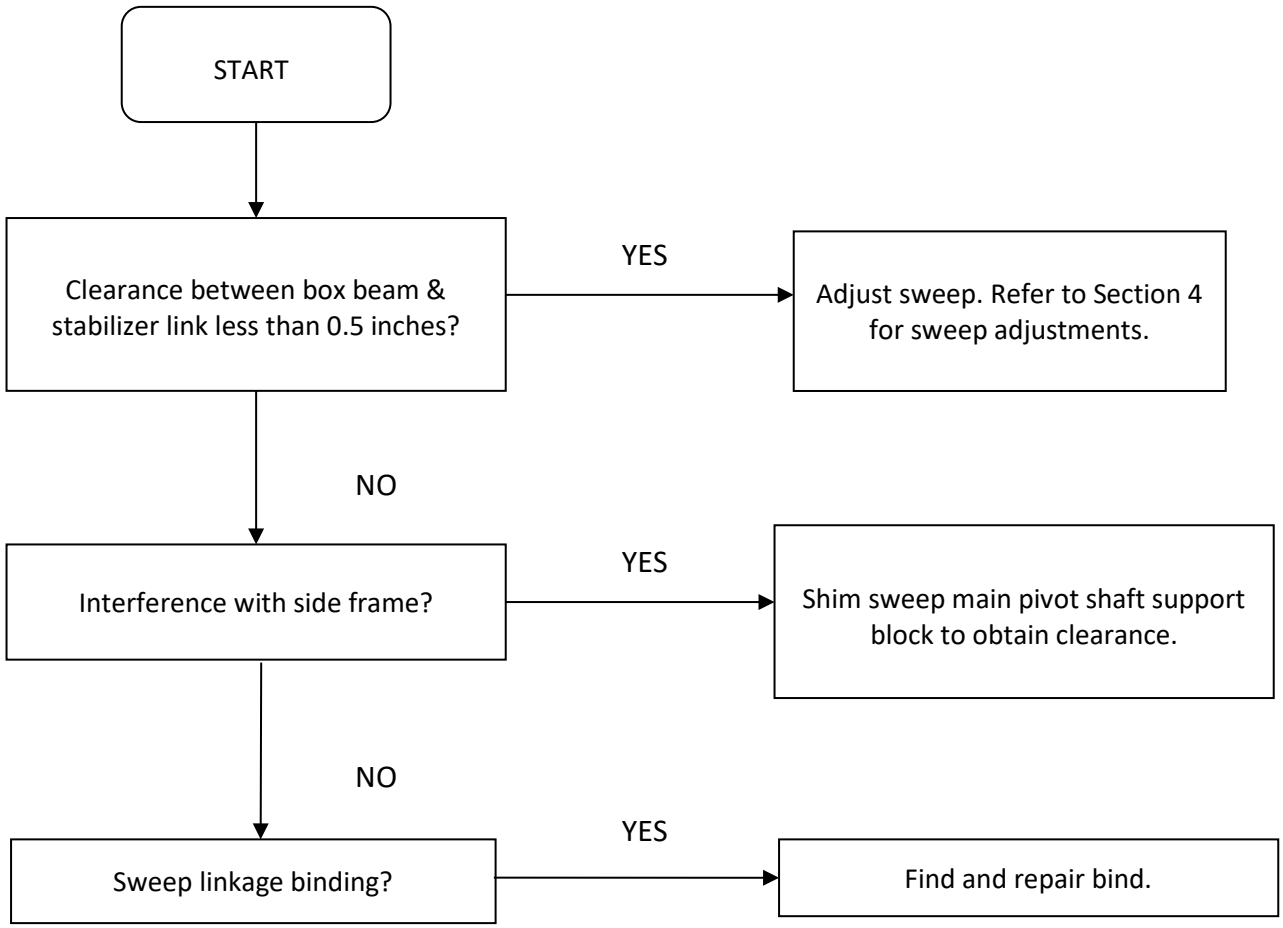

Figure 4.7-17

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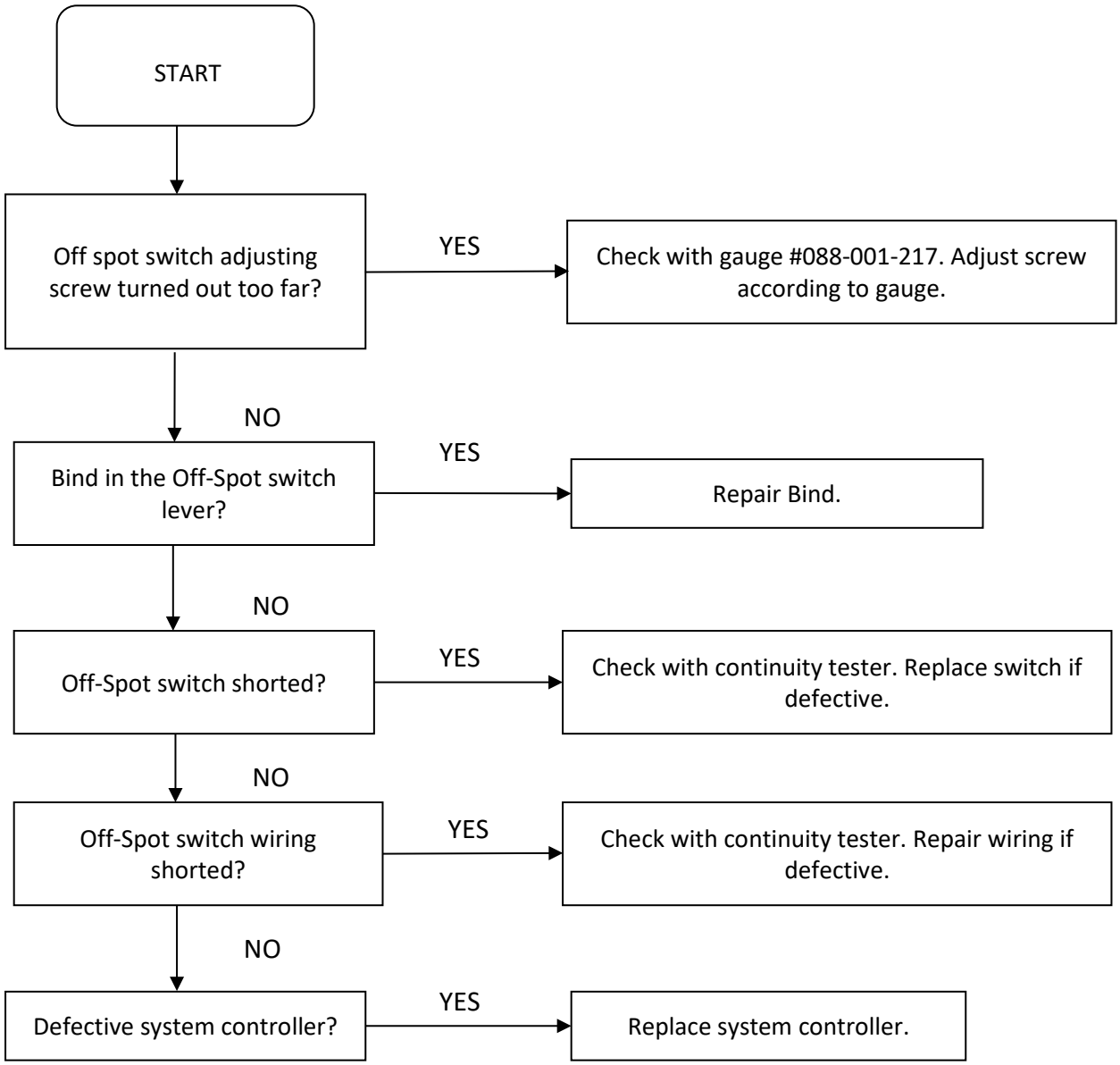
4.7.3.7. **PROBLEM: 1st ball – table comes down and picks up standing pins, but does not respot them. Sweep remains at guard position.**



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4.7.3.8. **PROBLEM: 1st ball - table comes down on top of an off spot pin, thus not picking up the pins. Then the sweep clears the pin deck. Table comes down to respot height, then table and sweep return to home.**

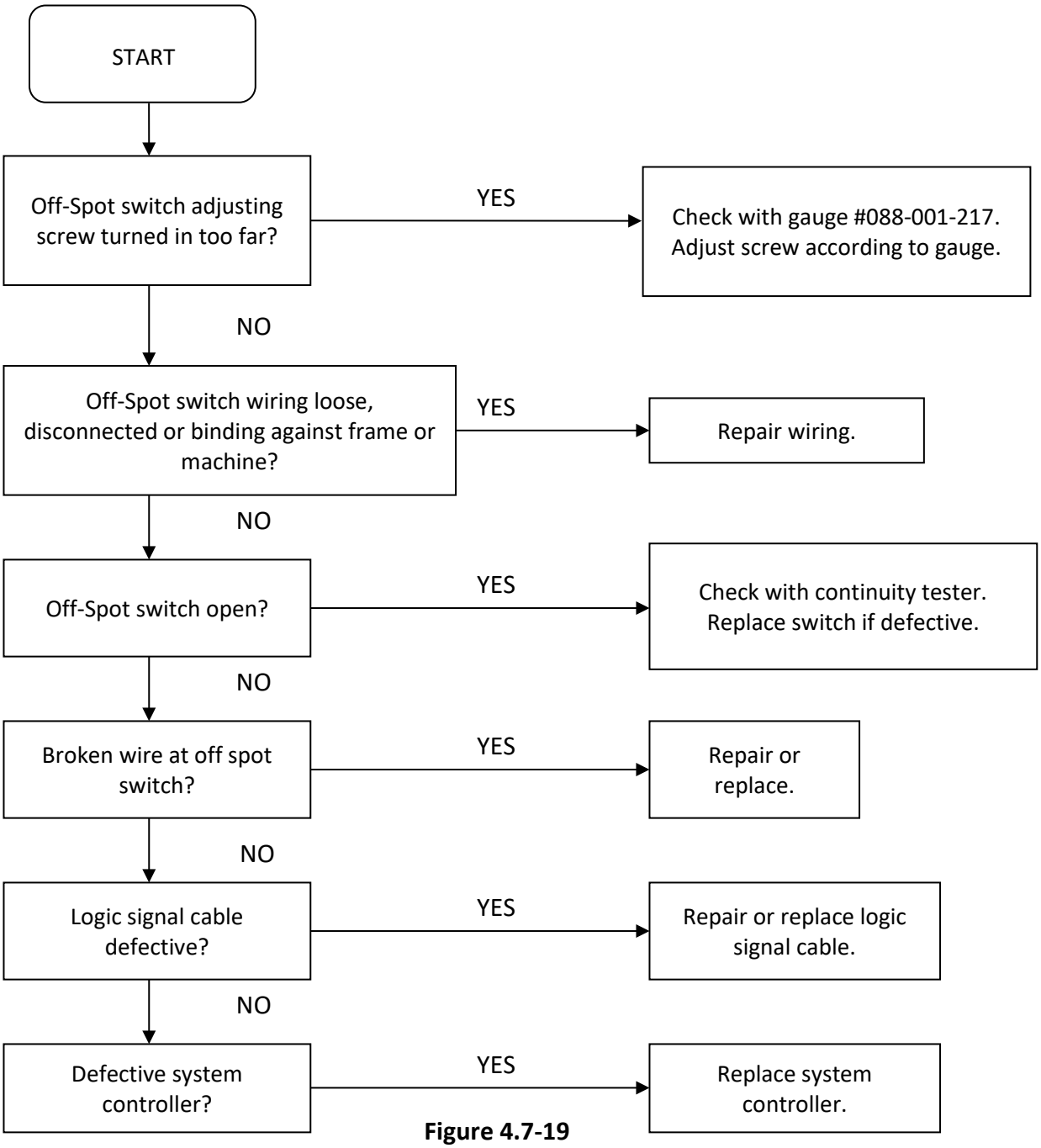

Figure 4.7-19

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4.7.3.9. **PROBLEM: 2nd ball or strike – table does not run, bins loaded with pins but will not drop the pins into the spotting cups.**

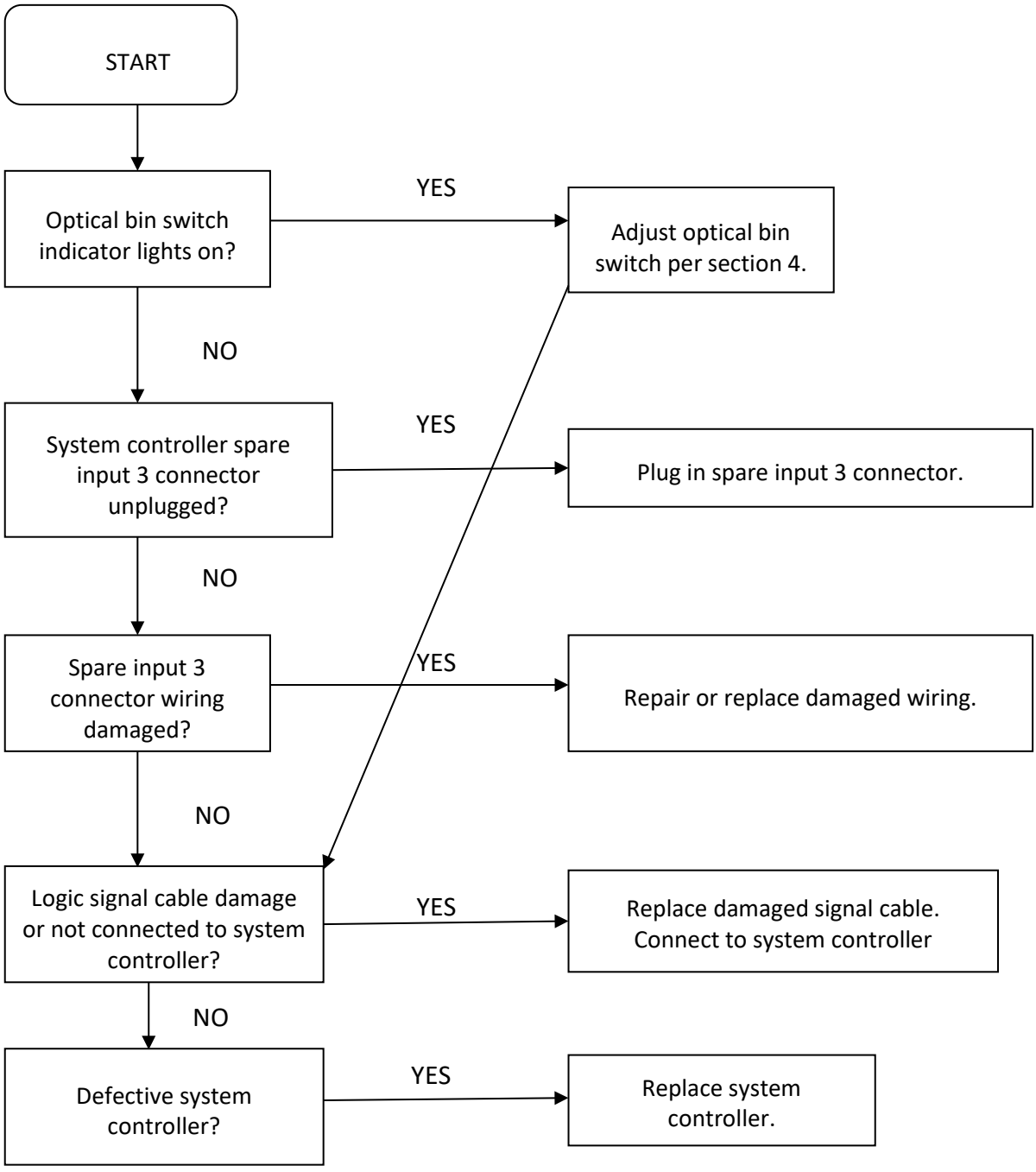

Figure 4.7-20

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4.7.3.10. **PROBLEM: Sweep runs too far into pit area.**

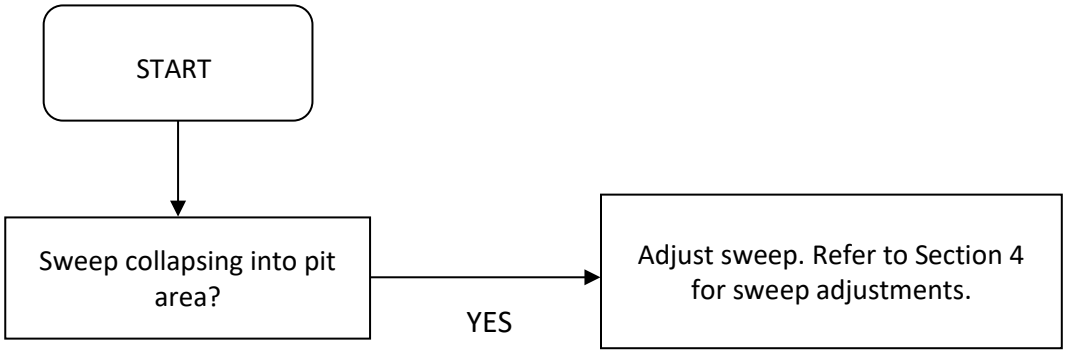

Figure 4.7-21

4.7.3.11. **PROBLEM: Sweep does not knock all pins into pit.**

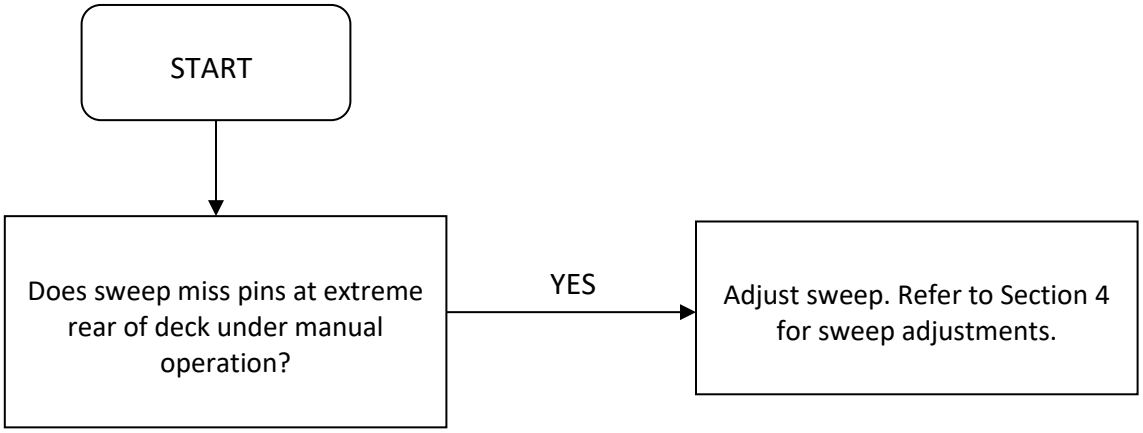

Figure 4.7-22

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4.7.4. Cushion and Pit Troubleshooting

4.7.4.1. PROBLEM: Ball idles at cushion.

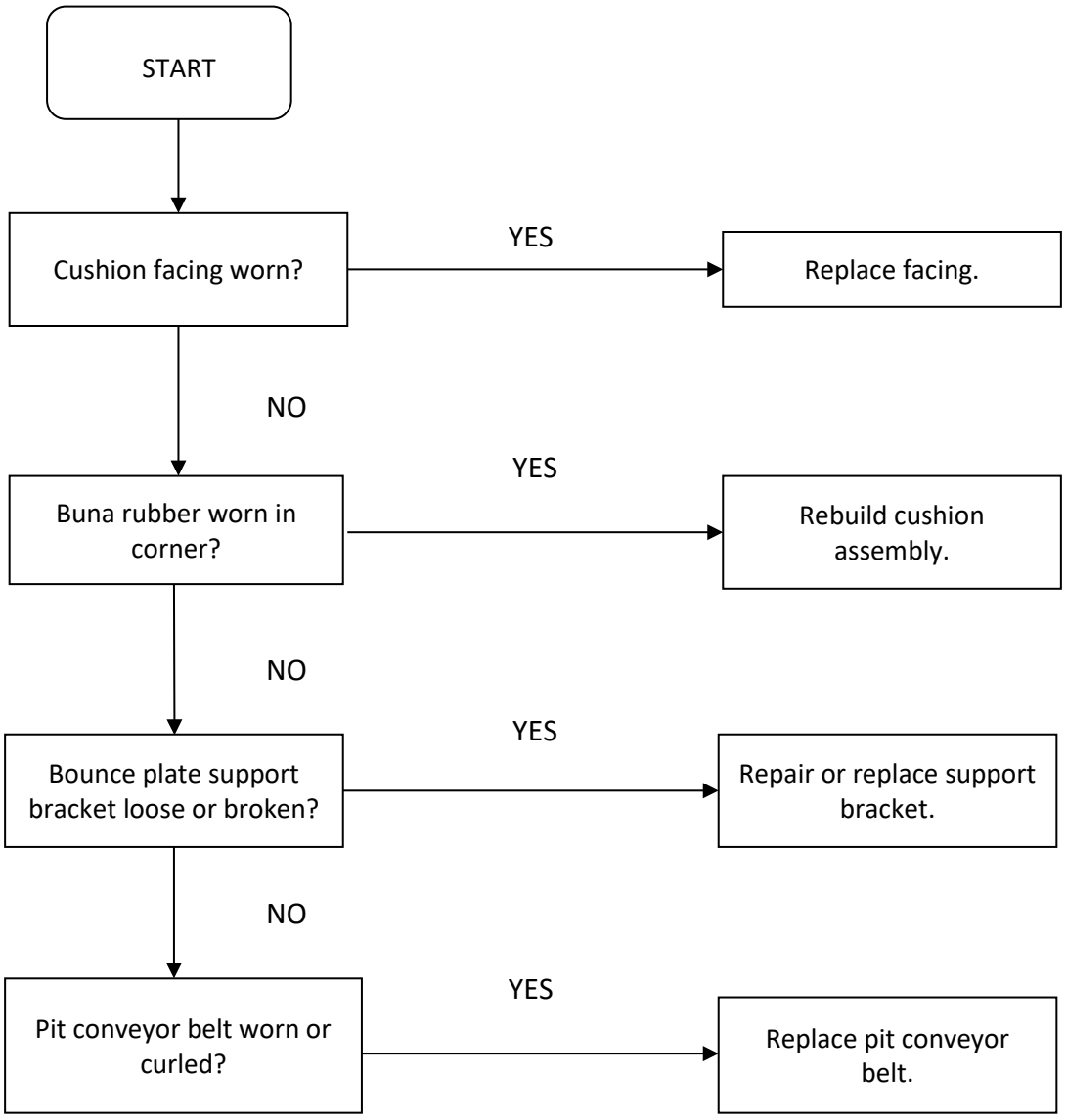

Figure 4.7-23

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4.7.4.2. **PROBLEM: Ball idles at exit – will not enter lift.**

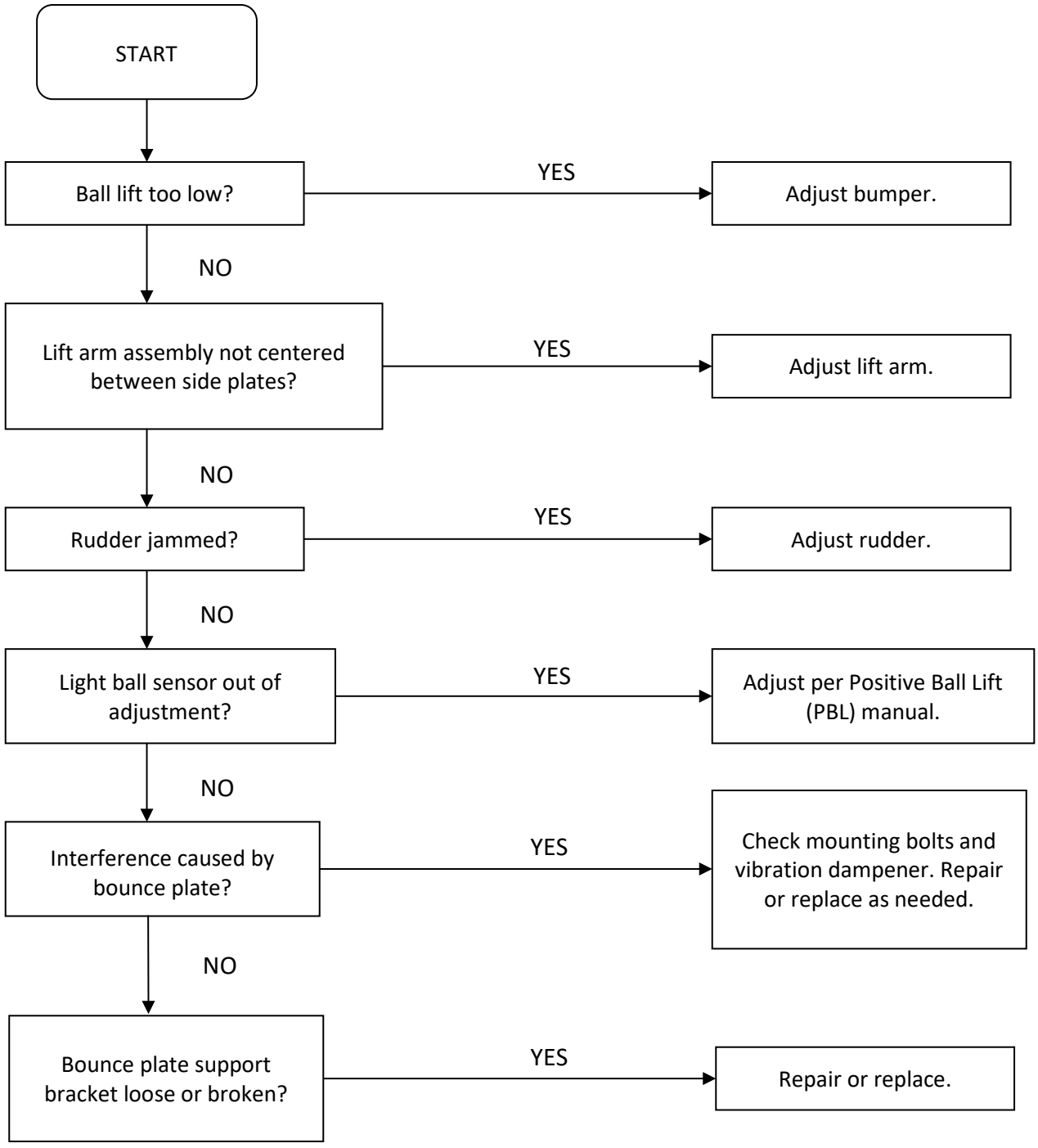

Figure 4.7-24

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4.7.4.3. **PROBLEM: Ball failed to cycle pinspotter.**

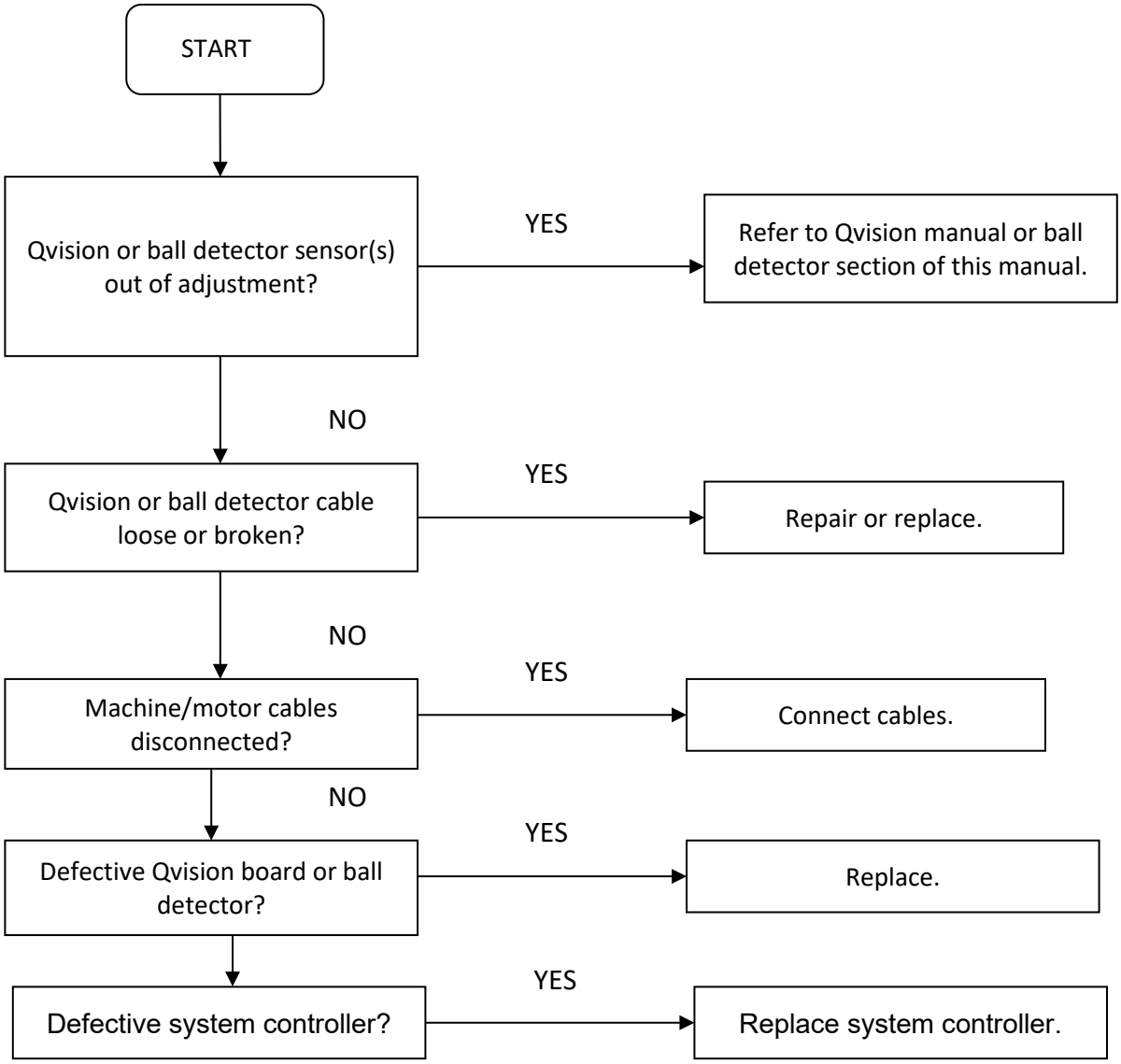

Figure 4.7-25

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4.7.4.4. **PROBLEM: Pinspotter continues to cycle or cycles randomly.**

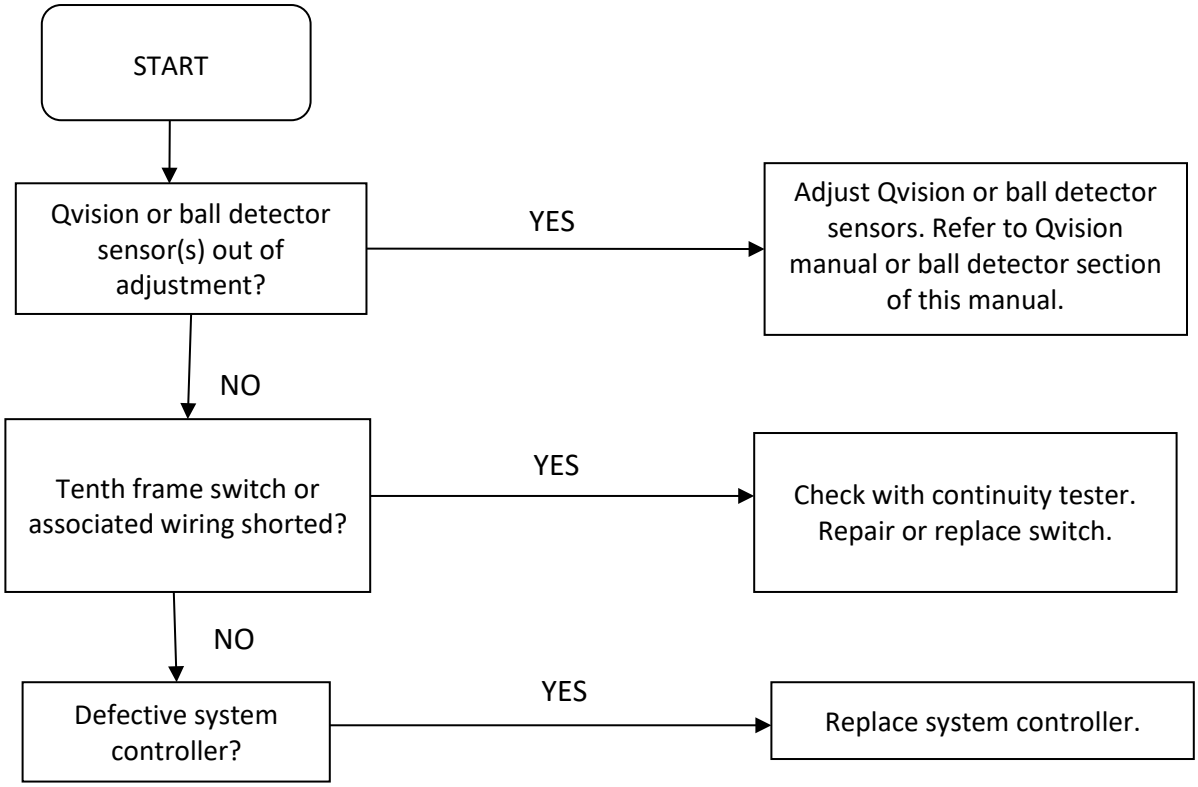

Figure 4.7-26

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4.7.4.5. **PROBLEM: Back end overload error and/or motor trips on overload.**

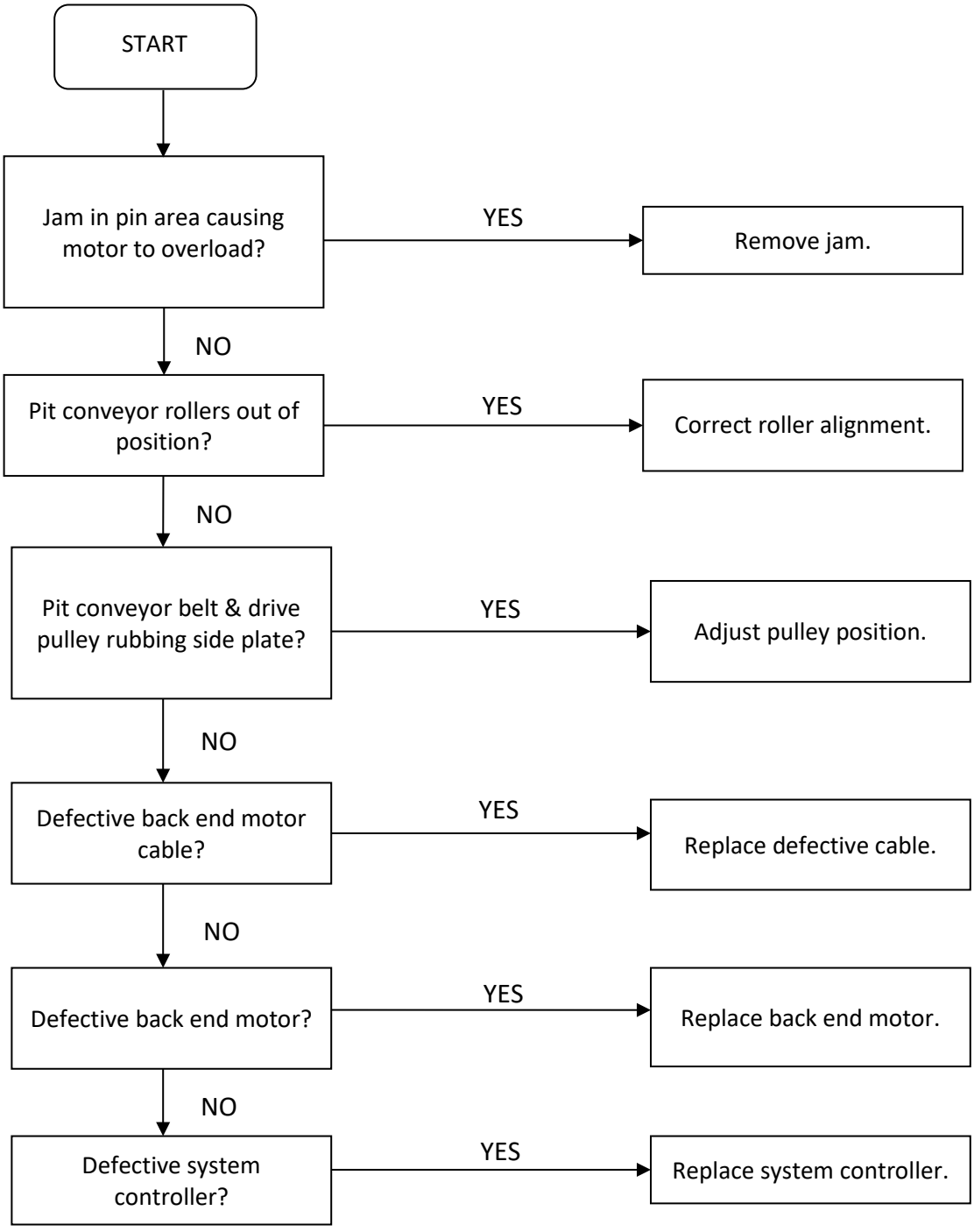

Figure 4.7-27

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4.7.5. System Controller Troubleshooting

4.7.5.1. PROBLEM: Table time delay too long or too short.

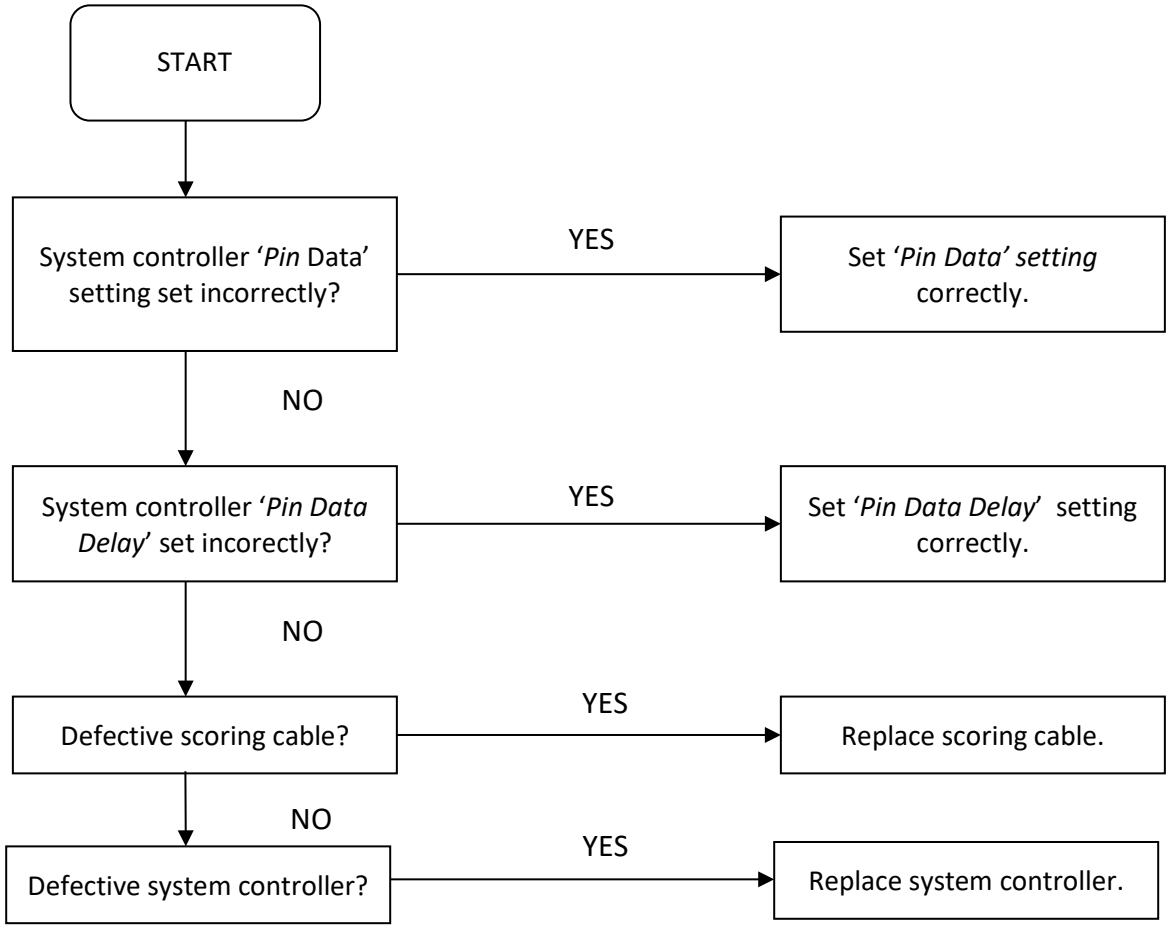

Figure 4.7-28

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4.7.5.2. **PROBLEM: Sweep time delay too long or too short.**

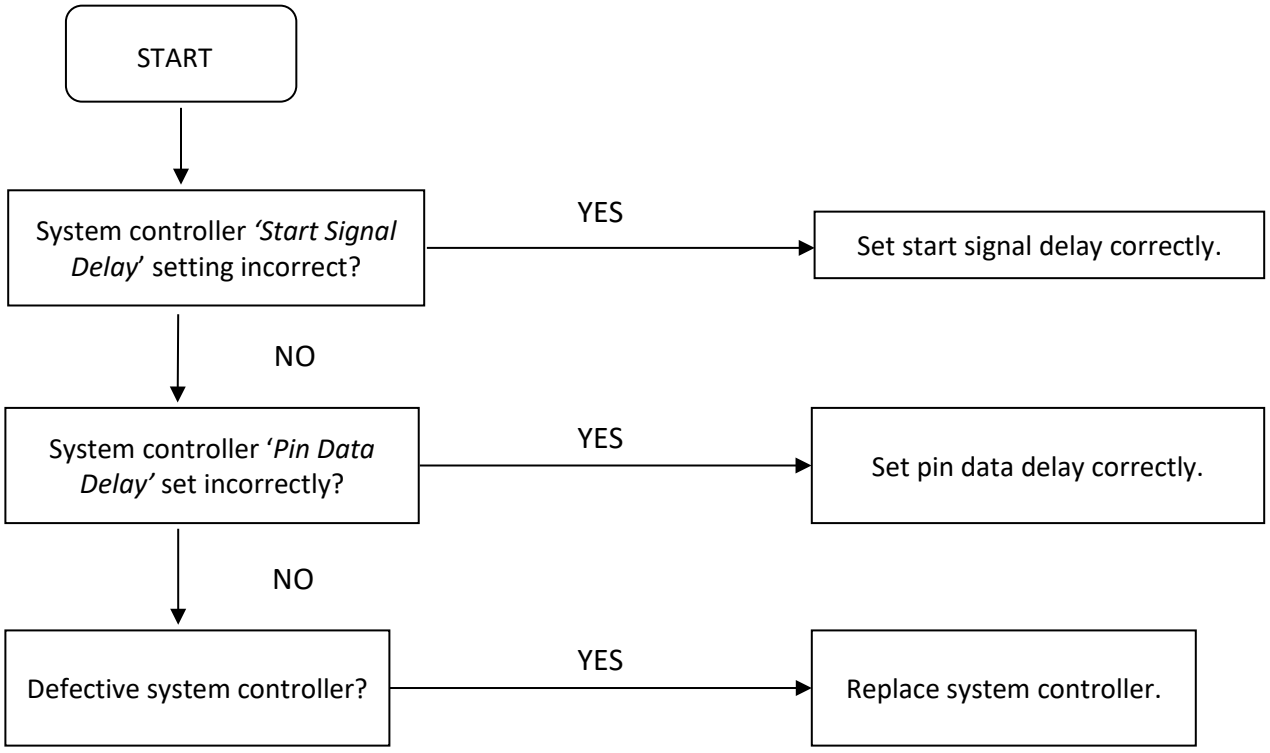

Figure 4.7-29

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4.7.5.3. **PROBLEM: Cannot turn pinspotter on from the MCU.**

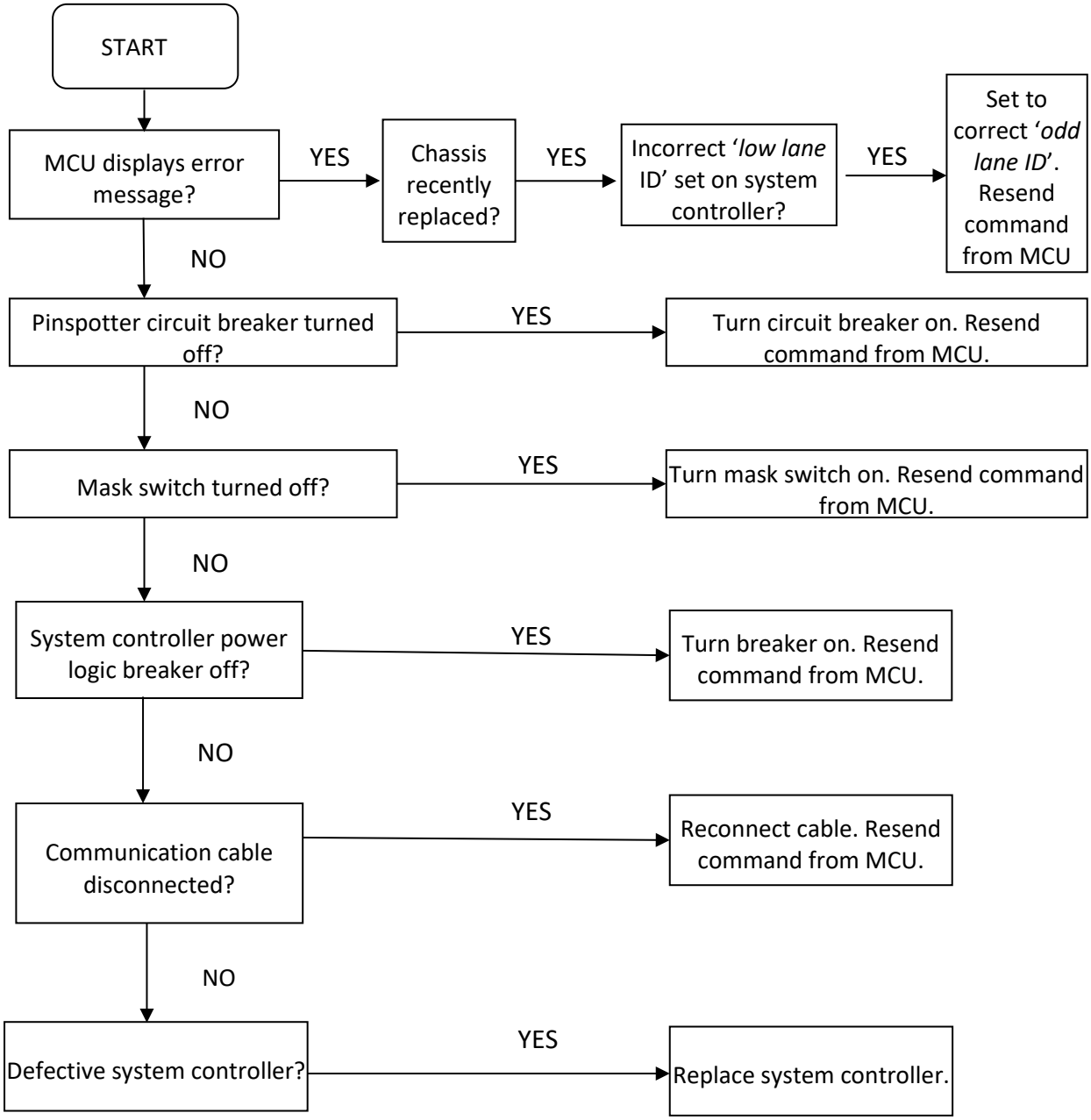

Figure 4.7-30

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4.7.5.4. **PROBLEM: Scoring chassis scores correctly on first ball but does not score on second ball. Second ball signal is not getting to chassis.**

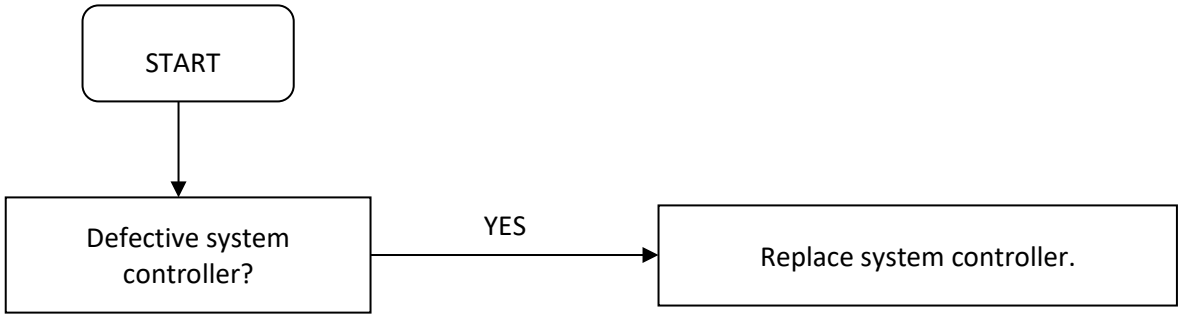

Figure 4.7-31

4.7.5.5. **PROBLEM: Scoring chassis is not scoring the first ball, but scores correctly on the second ball. Receiving second ball signal continuously.**

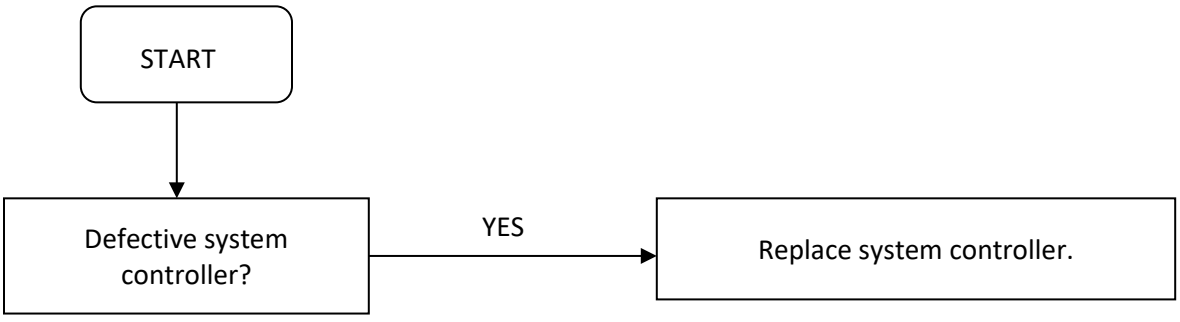

Figure 4.7-32

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4.7.6. **Motor Troubleshooting**

4.7.6.1. **PROBLEM: Front end motor will not run.**

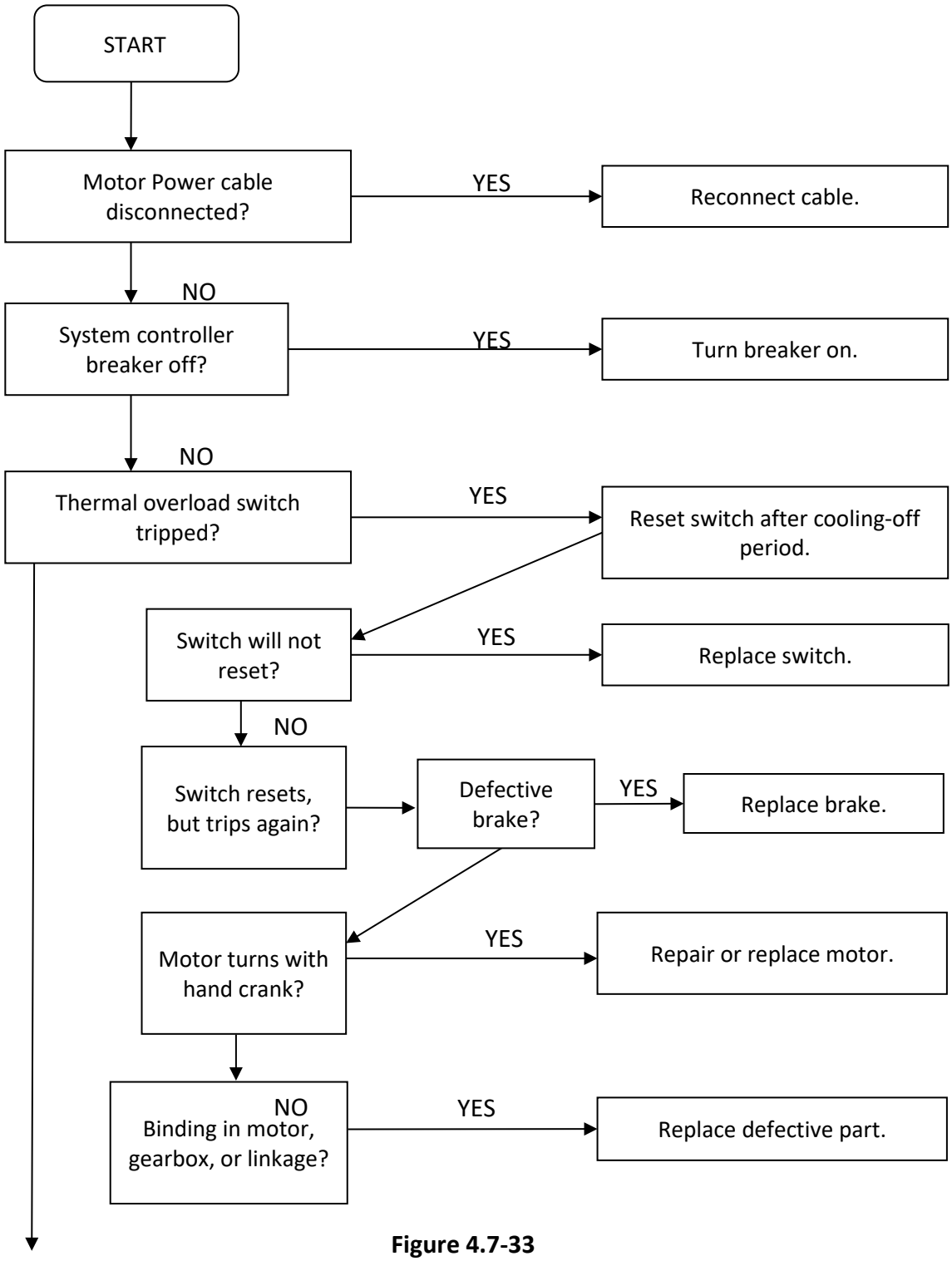

Figure 4.7-33

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PROBLEM: Front end motor will not run. (Continued from previous page.)

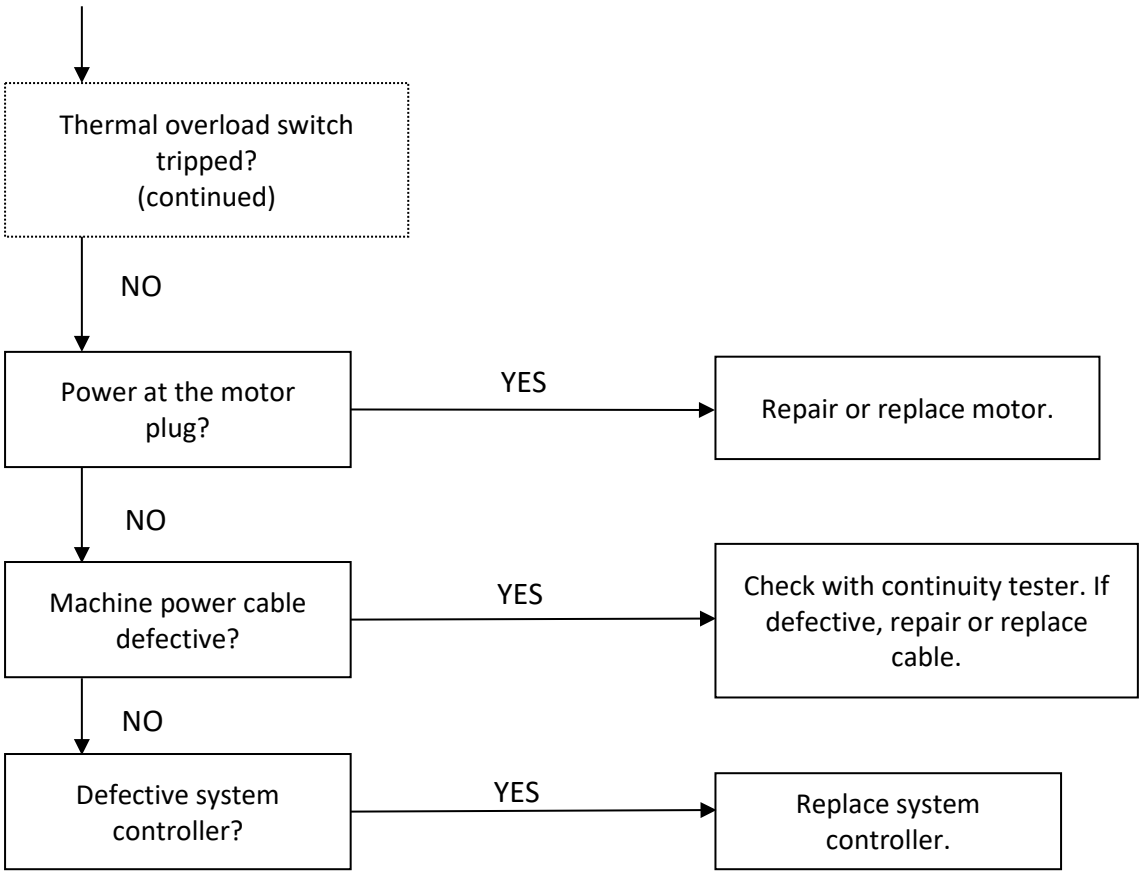

Figure 4.7-34

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4.7.7. Centerpunch Deck Lighting Troubleshooting (when not connected to Effects Server)

4.7.7.1. PROBLEM: Centerpunch Deck Lighting will not turn on.

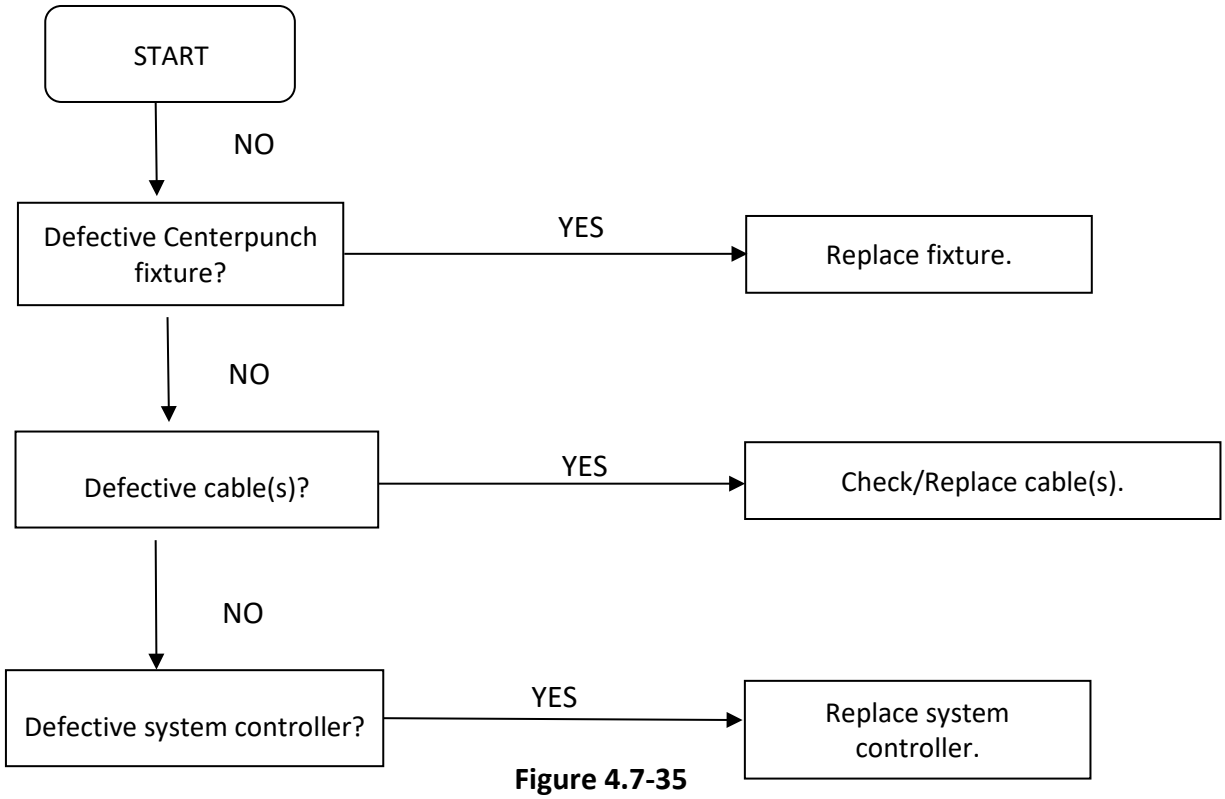

Figure 4.7-35

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Section 5 DRAWINGS & PART NUMBERS

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Contents

Section 5 DRAWINGS & PART NUMBERS....5-1
Front End Frame & Platform Assembly – Odd Machine....5-4
Front End Frame & Platform Assembly – Even Machine....5-6
Front End Frame Assembly – Even & Odd Machines....5-8
Front End Electrical Installation....5-10
Ball Detector Assembly....5-12
Front End Drive....5-14
Solenoid & Shuttle Operating Assembly....5-16
Table Drive Assembly....5-18
Spot & Respot Linkages....5-20
Sweep Arm Assembly....5-22
Sweep Bar & Mounting Assembly....5-24
Table & Crossbeam Assembly....5-26
Table & Bracket Assembly....5-29
Tie Rod Bracket Assembly....5-30
Front Actuator & Connector Assemblies....5-32
Table & Respot Links....5-34
Table & Respot Cells....5-36
Respot Cell Assembly Cells 7 through 10....5-38
Respot Cell Assembly, Cells 1 through 6....5-40
X Frame to Table Connections....5-42
Yoke & Spotting Cup Assembly....5-44
Durabin II Assembly....5-46
Durabin II Shuttle Actuator....5-48
Shuttle Assembly....5-50
Backend Assembly....5-53
Kickback Plate Assembly - Ball Exit Side....5-54
Kickback Plate Assembly – Opposite Ball Exit Side....5-56
Bounce Plate & Roller Assembly....5-58
Cushion, Curtain & Shock Absorber Assembly....5-61
Backend Gear, Motor & Bracket Assembly....5-62
System Controller & Mounting Bracket Assembly....5-64
Guards & Safety Labels....5-66
PARTS INDEX....5-71

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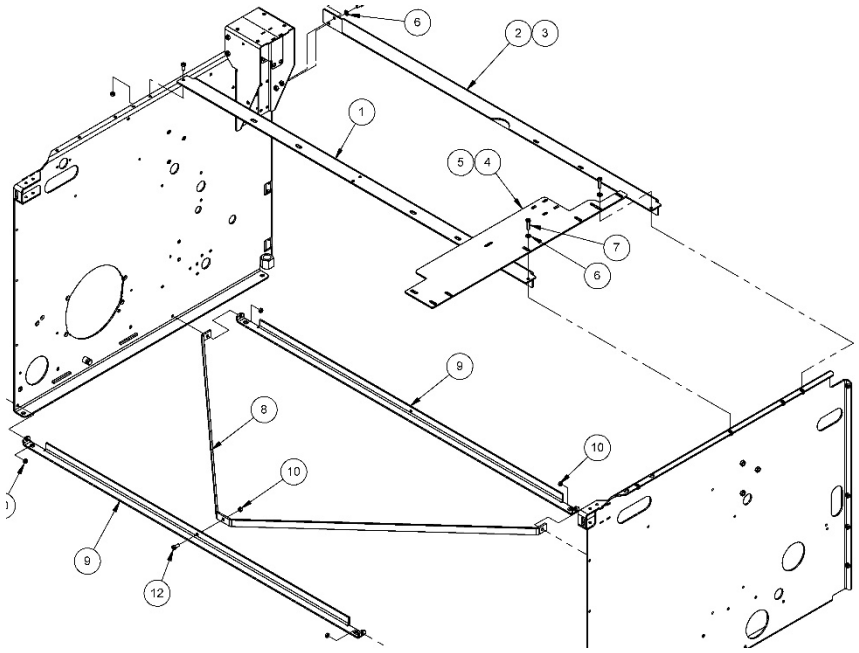
The drawings and parts lists in this section contain information that can be used for identifying and ordering replacement parts for your EDGE Free Fall Pinspotters. Becoming familiar with the numbering format used in this section will help you select the correct parts for your machine.

Because the older Left Hand (LH) / Right Hand (RH) convention for identifying machines *and* parts caused confusion, machines are now designated either EVEN or ODD based on whether they are normally installed on an even or odd numbered lane. For identifying similar parts within a machine (often mirror-image parts designed for a specific location), the designations 7-PIN SIDE and 10-PIN SIDE are now used, as these locations are easily identified and are independent of the point of reference, (i.e., from behind the machine or in front of the machine).

Often a single drawing is used to represent both the even and odd pinspotters (as shown below) because most of the parts that are being called out are common to both pinspotters. Occasionally two or more item numbers are shown associated with a single part (see items 2 & 3 and 4 & 5). When ganged item numbers refer to the same part in the drawing, the item number with the line pointing to the part is the one that is actually depicted (item 2 here). In the parts list, Item 2 also carries an EVEN MACHINE designation while item 3 carries an ODD MACHINE designation. In this case, the illustrated part is the part on the EVEN pinspotter. The part called out as item 3 is not shown and may be a mirror image of item 2 or may have other physical differences but provides the same function on the ODD pinspotter and carries a different part number. Both part numbers are included in the parts list. Be sure to read the descriptions carefully.



Some ganged item numbers, for example, 8 8A represent a main component 8 and an assembly that contains 8A the main component. Assemblies contain two or more parts (refer to the assembly's item description to see which parts are included in the assembly) and may be the more efficient or convenient means of replacing the main component. The part numbers for both the main component and the assembly are listed separately.

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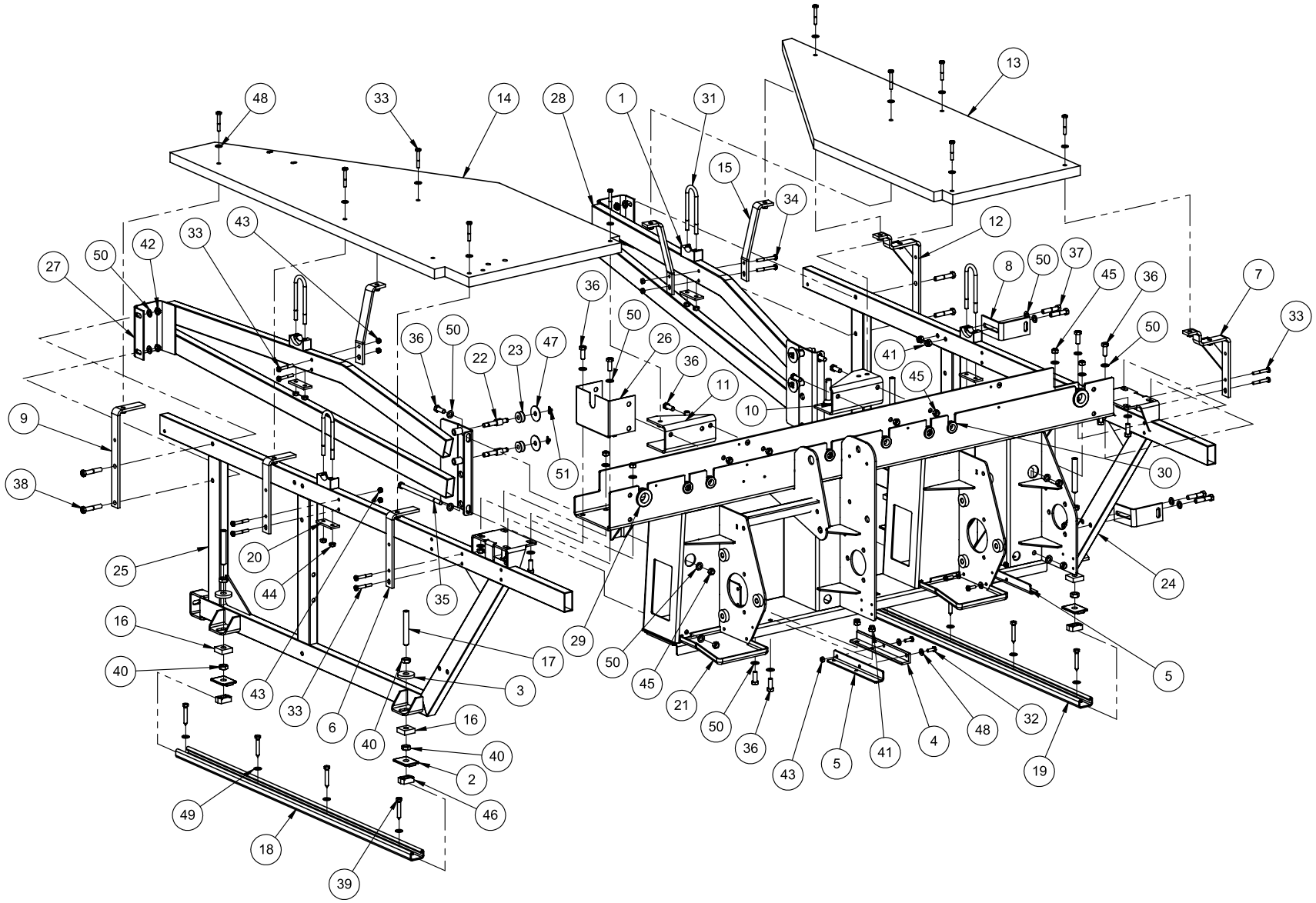

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ITEM	QTY	PART #	DESCRIPTION
1	4	000-021-528	SADDLE
2	4	000-021-786	BEARING PLATE, FRAME ADJ
3	4	000-021-787	FW 0.56 X 1.63 X 0.25 BO
4	1	070-001-596	ANGLE, STOP BRACKET WLDMT
5	2	070-001-698	PIT LIGHT BRACKET
6	2	070-001-817	PLATFORM ANGLE WELDMENT
7	1	070-001-819	PLTFRM SPPRT WLDMT
8	2	070-004-654	BALL ELEVATOR TRACK SUPP BRKT
9	1	070-006-405	PLTFRM SPPRT BRKT, COMMON
10	1	070-006-411	BIN SUPPORT WLDMT, RH
11	1	070-006-413	BIN SUPPORT WLDMT, LH
12	1	070-006-414	REAR PLTFRM SPPRT WLDMT
13	1	070-006-425	BALL DOOR SIDE PLATFORM
14	1	070-006-426	WALKBOARD, COMMON
15	3	070-006-490	PLTFRM SPPRT BRKT, BR SIDE
16	4	070-007-509	QN 1/2-13 NS
17	4	070-007-510	SSS 1/2-13 X 3.50 CUP BO
18	1	070-007-843	KICKBACK UNISTRUT LONG
19	1	070-007-844	KICKBACK UNISTRUT SHORT
20	4	070-008-126	CLAMP BAR
21	1	088-500-200	CROSSBEAM WLDMT, WIDE DUCT
22	4	090-002-028	PIN SPRING ROLLER
23	4	090-003-795	SPRING ROLLER
24	1	090-004-002	SIDE FRAME RHG, RH MACHINE
25	1	090-004-006	SIDE FRAME LH, LH / RH MACHINE
26	1	090-005-034	END PLATE, FRNT END CRSSBM

ITEM	QTY	PART #	DESCRIPTION
27	1	090-005-646	LH FRAME BRACE WLDMT
28	1	090-005-647	RH FRAME BRACE WLDMT
29	2	250-001-046	GPI 1.00 X 1.38 X 0.25 RB
30	8	711-520-017	GPI 0.63 X 0.88 X 0.19 RB 1
31	4	804-557-731	UB 5/16-18 X 4.44 GR5 BO
32	4	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
33	18	809-849-285	HHCS 1/4-20 X 1.75 GR8 BO
34	2	809-849-325	HHCS 1/4-20 X 2.00 GR8 BO
35	2	809-865-104	HHCS 3/8-16 X 6.50 GR8 PB
36	16	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
37	4	809-865-285	HHCS 3/8-16 X 1.75 GR8 PB
38	4	809-865-325	HHCS 3/8-16 X 2.00 GR8 PB
39	8	810-556-320	HHLB 5/16 X 2.00 NS
40	8	835-573-002	HFJN 1/2-13 ZN
41	6	839-665-002	HLN 3/8-16 FLX CAD L/F
42	4	840-065-002	HLN 3/8-16 FLX CAD H/T
43	12	844-049-002	HLN 1/4-20 CAD STV
44	8	844-057-002	HLN 5/16-18 CAD STV
45	16	844-065-002	HLN 3/8-16 CAD STV
46	4	853-500-001	UNISTRUT NUT
47	4	945-867-242	FW 0.41 X 1.50 X 0.06 ZN
48	14	948-753-102	FW 1/4 SAE NS
49	8	948-761-112	FW 5/16 SAE NS
50	34	948-767-132	FW 0.41 X 0.73 X 0.06 ZN
51	4	963-400-002	RNG XW 0.190 X 0.065 NS SP

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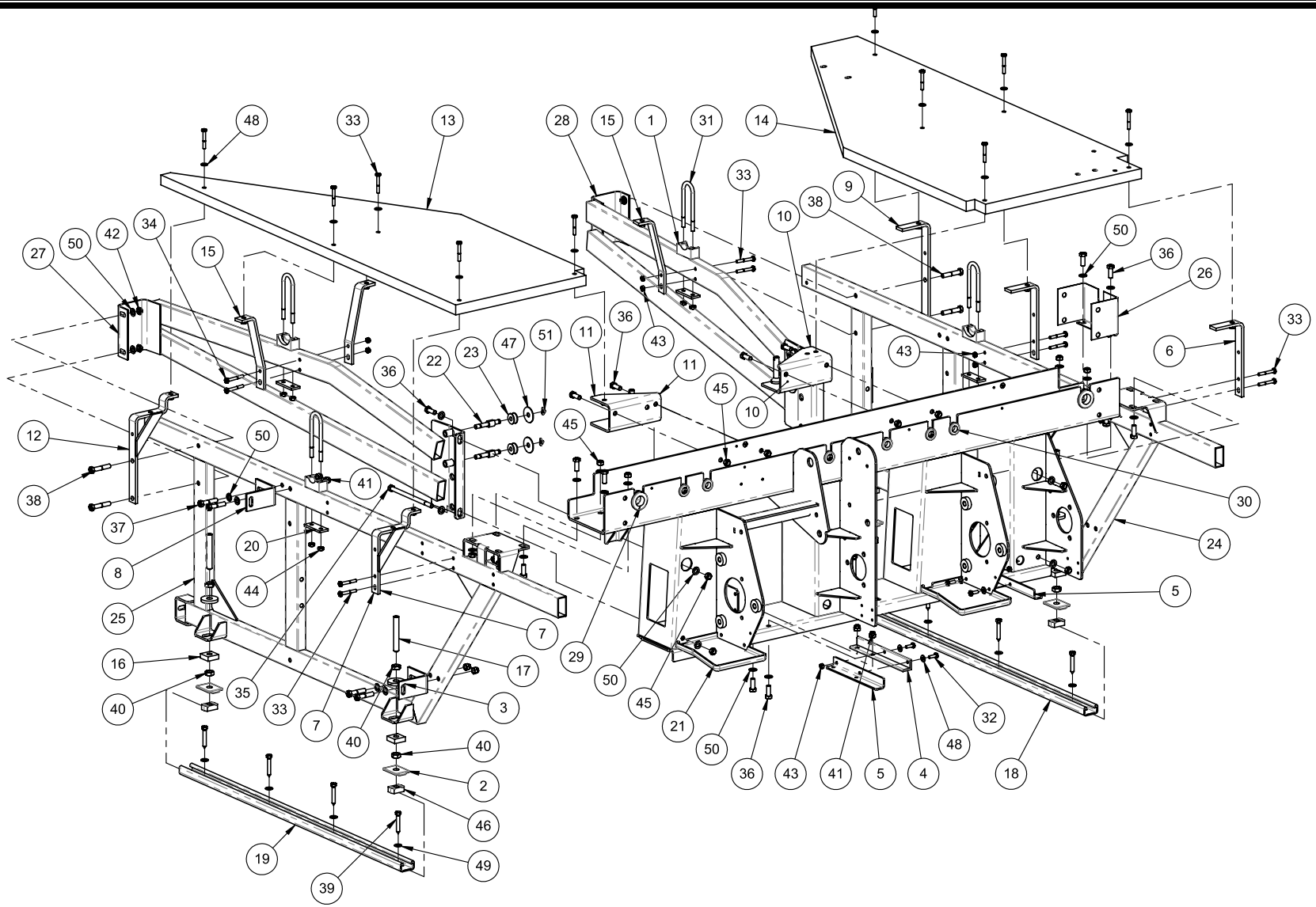

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13	1	070-006-425	BALL DOOR SIDE PLATFORM
14	1	070-006-426	WALKBOARD, COMMON
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33	18	809-849-285	HHCS 1/4-20 X 1.75 GR8 BO
34	2	809-849-325	HHCS 1/4-20 X 2.00 GR8 BO
35	2	809-865-104	HHCS 3/8-16 X 6.50 GR8 PB
36	16	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
37	2	809-865-285	HHCS 3/8-16 X 1.75 GR8 PB
38	4	809-865-325	HHCS 3/8-16 X 2.00 GR8 PB
39	8	810-556-320	HHLB 5/16 X 2.00 NS
40	8	835-573-002	HFJN 1/2-13 ZN
41	4	839-665-002	HLN 3/8-16 FLX CAD L/F
42	4	840-065-002	HLN 3/8-16 FLX CAD H/T
43	12	844-049-002	HLN 1/4-20 CAD STV
44	8	844-057-002	HLN 5/16-18 CAD STV
45	16	844-065-002	HLN 3/8-16 CAD STV
46	4	853-500-001	UNISTRUT NUT
47	4	945-867-242	FW 0.41 X 1.50 X 0.06 ZN
48	14	948-753-102	FW 1/4 SAE NS
49	8	948-761-112	FW 5/16 SAE NS
50	30	948-767-132	FW 0.41 X 0.73 X 0.06 ZN
51	4	963-400-002	RNG XW 0.190 X 0.065 NS SP

WORLDWIDE HEADQUARTERS
8100 AMF Drive - Mechanicsville, Va 23111 - USA
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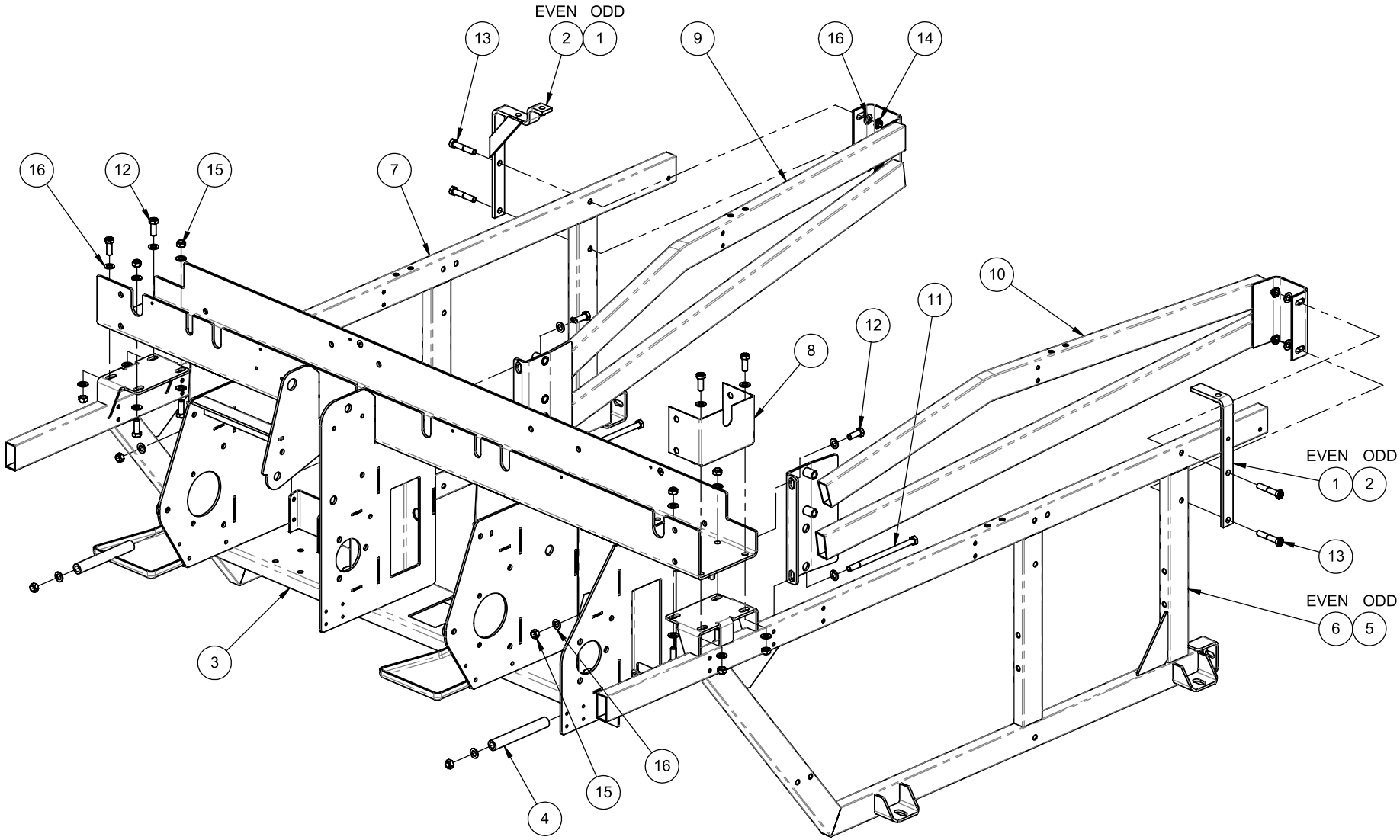

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1	1	070-006-405	PLTFRM SPPRT BRKT, COMMON
2	1	070-006-414	REAR PLTFRM SPPRT WLDMT
3	1	088-500-200	CROSSBEAM WLDMT, WIDE DUCT
4	2	088-500-222	CROSSBEAM SPACER
5	1	090-004-002	SIDE FRAME RHG, RH MACHINE
6	1	090-004-003	SIDE FRAME, LH MACHINE
7	1	090-004-006	SIDE FRAME LH, LH / RH MACHINE
8	1	090-005-034	END PLATE, FRNT END CRSSBM
9	1	090-005-646	LH FRAME BRACE WLDMT
10	1	090-005-647	RH FRAME BRACE WLDMT
11	2	809-865-104	HHCS 3/8-16 X 6.50 GR8 PB
12	10	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
13	4	809-865-325	HHCS 3/8-16 X 2.00 GR8 PB
14	4	840-065-002	HLN 3/8-16 FLX CAD H/T
15	12	844-065-002	HLN 3/8-16 CAD STV
16	28	948-767-132	FW 0.41 X 0.73 X 0.06 ZN

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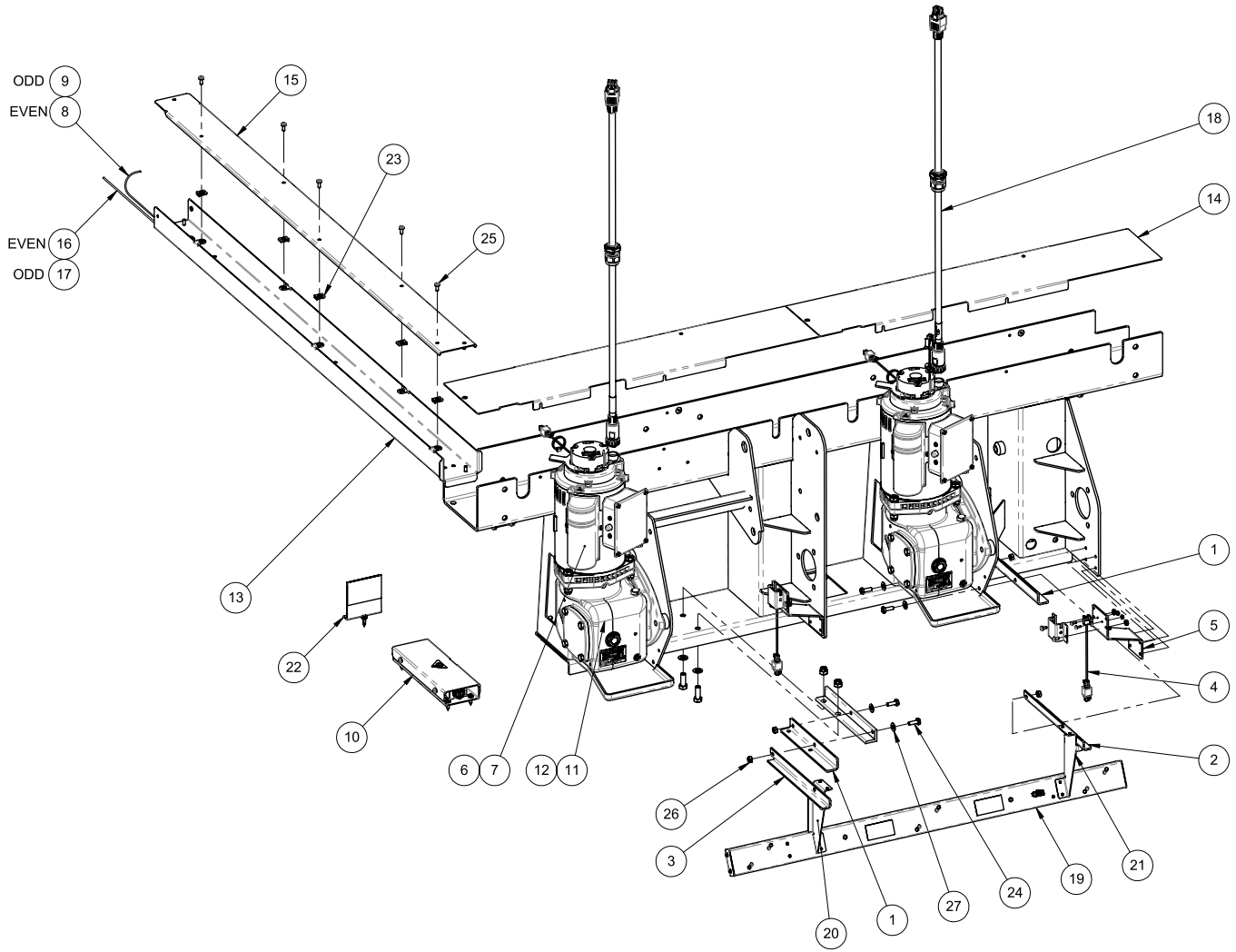
NOTE: EVEN MACHINE SHOWN. ODD MACHINE HAS CABLE DUCT ON THE OPPOSITE END OF THE CROSSBEAM



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ITEM	QTY	PART #	DESCRIPTION
1	2	070-001-698	PIT LIGHT BRACKET
2	1	070-001-907	PITLIGHT MTG ANGLE-10 PIN SIDE
3	1	070-001-908	PITILGHT MTG ANGLE-7 PIN SIDE
4	2	088-000-022	ENCODER / HOME SENSOR ASM
5	2	088-000-107	HOME ASM
6	2	088-000-145	COMPLETE XLi MOTOR ASM, 50HZ
7	2	088-000-146	COMPLETE MOTOR ASM 90XLi 60HZ
8	1	088-000-242	EVEN MACHINE SIGNAL CABLE
9	1	088-000-243	ODD MACHINE SIGNAL CABLE
10	1	088-000-500	ASM, BALL DETECTOR
11	2	088-004-604	FE GEARBOX, 60Hz, BG
12	2	088-004-609	FE GEARBOX, 50Hz, BG
13	1	088-200-477	FE WIDE CABLE DUCT ASM
14	2	088-500-225	ASM, BOX BEAM COVER
15	1	088-500-226	ASM, FE WIDE CABLE DUCT COVER
16	1	088-500-238-01	EVEN MACHINE POWER CABLE
17	1	088-500-239-01	ODD MACHINE POWER CABLE
18	2	090-005-876	MOTOR CABLE
19	1	275-002-035	CP DECK LIGHT FIXTURE
20	1	289-X09-216	PIT LIGHT BRACKET, LEFT
21	1	289-X09-217	PIT LIGHT BRACKET, RIGHT
22	1	610-088-092	REFLECTOR KIT
23	5	724-511-074	10-32 TINNERMAN U TYPE NUT
24	4	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
25	5	818-240-082	PHPMS 10-32 X 0.50 ZN SEMS
26	4	844-049-002	HLN 1/4-20 CAD STV
27	4	948-753-102	FW 1/4 SAE NS

ITEM	QTY	PART #	DESCRIPTION

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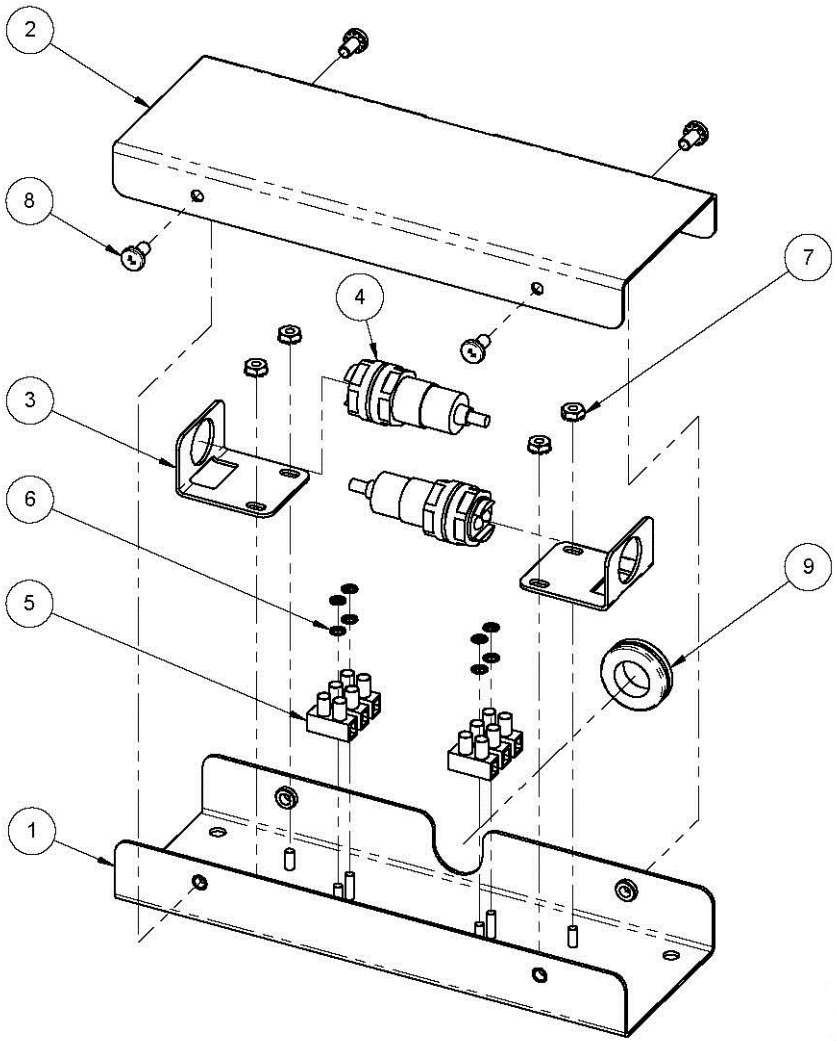

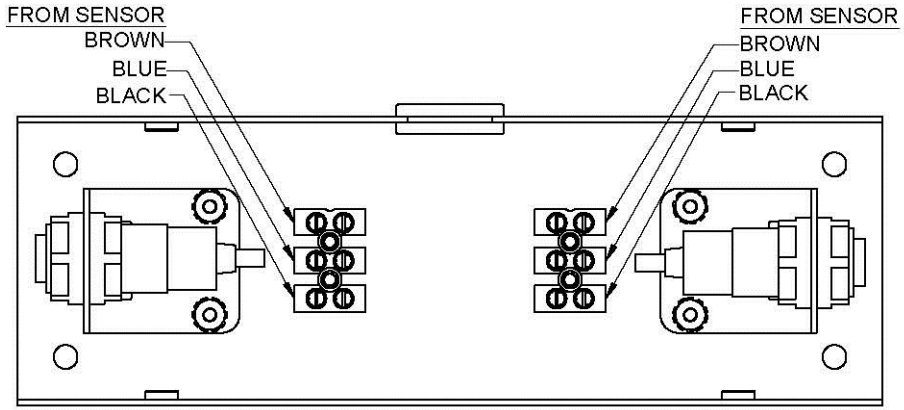

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ITEM	QTY	PART #	DESCRIPTION
1	1	088-000-502	BALL DETECTOR BASE ASSEMBLY
2	1	088-000-503	BALL DETECTOR COVER
3	2	088-000-504	BALL DETECTOR SENSOR BRACKET
4	2	088-000-422	OPTICS RETROFLECTIVE SENSOR
5	2	760-600-028	TERMINAL STRIP 18-10AWG 3C 1R
6	8	848-537-480	PN 0.183 X 0.25 X 0.031 NS
7	4	843-127-002	KN 6-32 ZN
8	4	818-240-062	PHPMS 10-32 X 0.38 ZN SEMS
9	1	711-520-012	GPI 0.63 X 0.88 X 0.06 RB 1

ITEM	QTY	PART #	DESCRIPTION

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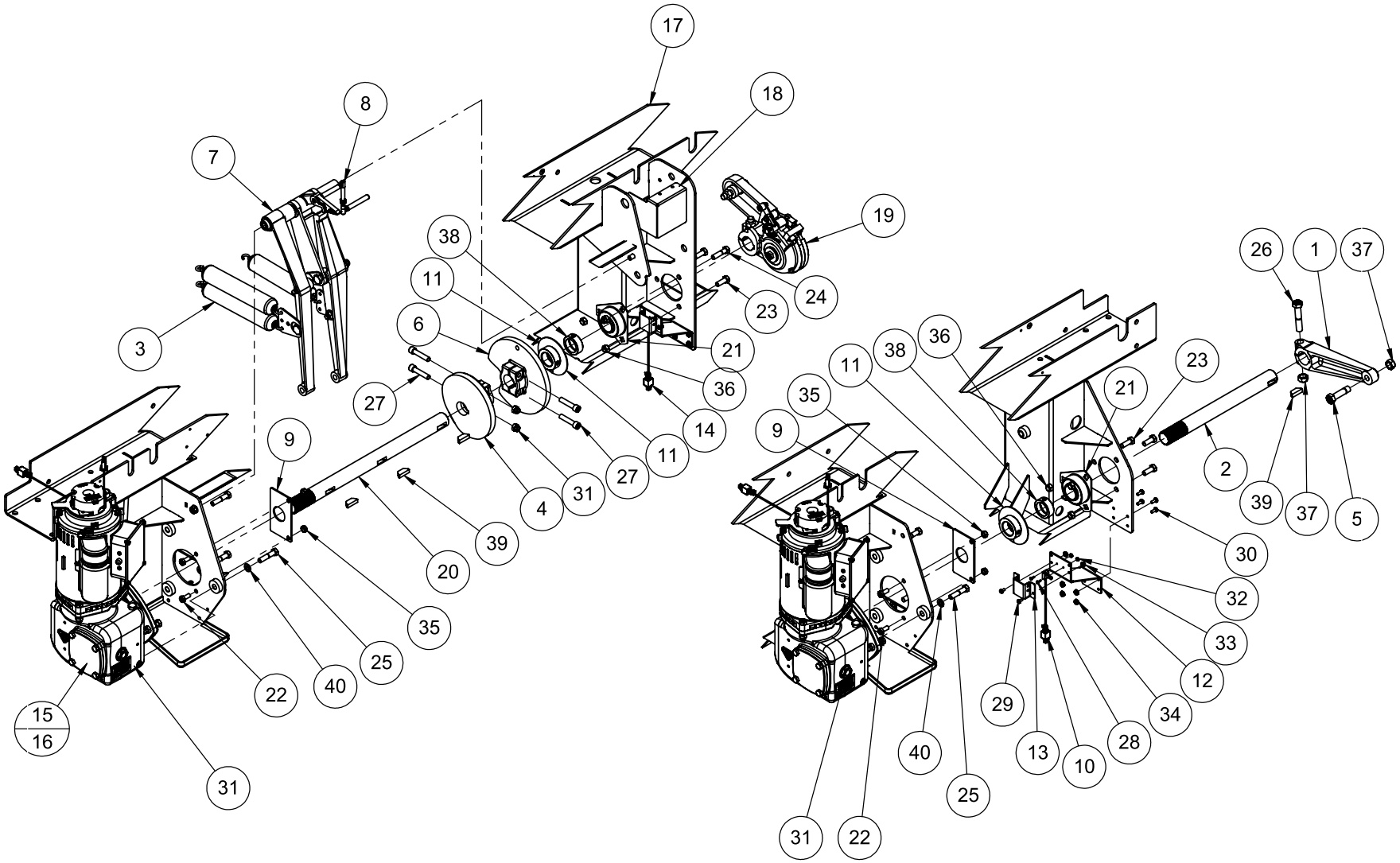

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ITEM	QTY	PART #	DESCRIPTION
1	1	000-023-139	CRANK, SWEEP MOTOR
2	1	070-001-699	SWEEP DRIVE SHAFT
3	3	070-001-707	SPRING, SPOT & RESPOT ARMS
4	1	070-001-910	SPOT & RESPOT CAM
5	1	070-003-243	HHCS 1/2-13 X 2.00 GR8 0.5 PT
6	1	070-006-427	SHUTTLE CAM
7	1	070-006-492	LINK ARM ASM, RESPOT
8	1	070-006-493	BALL JOINT ASM, SPOT LATCH
9	2	070-006-765	SHAFT PLATE
10	1	088-000-022	ENCODER / HOME SENSOR ASM
11	2	088-000-038	HOME DISC ASM
12	1	088-000-039	HOME SENSOR BRKT
13	1	088-000-040	SENSOR COVER
14	1	088-000-107	HOME ASM
15	2	088-000-172	COMPLETE FE DRIVE, 50 Hz
16	2	088-000-173	COMPLETE FE DRIVE, 60HZ
17	1	088-500-200	CROSSBEAM WLDMT, WIDE DUCT
18	1	090-005-029	SOLENOID COVER
19	1	090-005-550	TABLE DRIVE ASM
20	1	090-005-565	TABLE DRIVE SHAFT
21	2	701-420-034	BRG, 1-1/4 BORE, 3 BLT FLG
22	4	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
23	5	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
24	1	809-865-245	HHCS 3/8-16 X 1.50 GR8 BO
25	6	809-865-285	HHCS 3/8-16 X 1.75 GR8 PB
26	1	809-873-405	HHCS 1/2-13 X 2.50 GR8 PB
27	4	810-265-280	SHSCS 3/8-16 X 1.75 BO
28	2	817-921-060	PHPMS 4-40 X 0.38 ZN SEMS
29	2	818-233-062	PHPMS 8-32 X 0.38 ZN SEMS
30	8	818-240-082	PHPMS 10-32 X 0.50 ZN SEMS
31	9	839-665-002	HLN 3/8-16 FLX CAD L/F
32	2	843-121-002	KN 4-40 ZN
33	2	843-133-002	KN 8-32 ZN
34	8	843-140-002	KN 10-32 ZN
35	4	844-057-002	HLN 5/16-18 CAD STV
36	5	844-065-002	HLN 3/8-16 CAD STV
37	2	844-073-002	HLN 1/2-13 CAD STV
38	2	902-900-110	SHAFT COLLAR
39	4	907-000-900	KEY HP 0.31 X 1.13
40	6	951-164-002	SWM 3/8 ANSI NS

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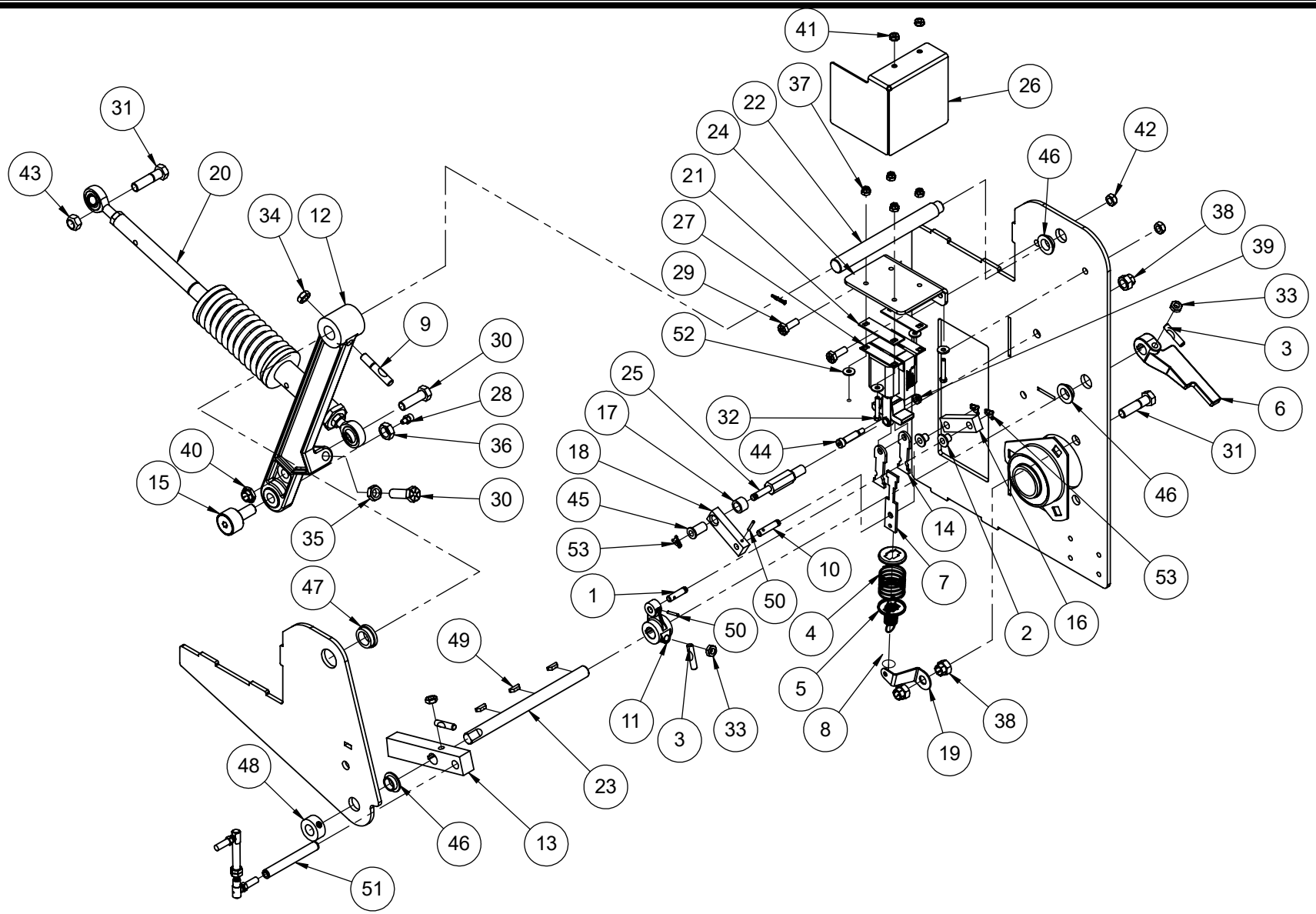

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ITEM	QTY	PART #	DESCRIPTION
1	1	070-001-777	LINK PIN
2	2	070-002-653	BSH FS 0.25 X 0.32 X 0.38 BZ
3	3	070-006-116	CLAMP STUD-CARRIAGE SUPPORT
4	1	070-006-276	SHUTTLE OVERTRAVEL SPRING
5	2	070-006-277	SPRING WASHER
6	1	070-006-278	LEVER CAM, SHUTTLE DR
7	1	070-006-282	LINK, SHUTTLE SPRING, LOWER
8	1	070-006-283	TENSION SPRING-SOLENOID
9	1	070-006-284	CLMP STUD, 5/16-18 X 1.75
10	1	070-006-287	PIN, LONG
11	1	070-006-292	LINK, SPOT SOLENOID
12	1	070-006-295	SHUTTLE OP ROD
13	1	070-006-456	STOP LEVER
14	2	070-006-724	LINK, SHUTTLE SPRING, UPPER
15	1	070-006-728	CAM FOLLOWER
16	1	070-008-132	LINK
17	1	070-008-133	LINK ASM SPACER
18	1	070-008-134	LINK
19	1	088-001-293	SPRING CLIP
20	1	088-001-631	SHUTTLE ROD ASM, LG SPR
21	2	090-003-459	DAMPENER, BASE
22	1	090-004-017	RESPOT LEVER SHAFT
23	1	090-005-017	SOLENOID PIVOT SHAFT
24	1	090-005-018	HANGER BRACKET
25	1	090-005-028	SOLENOID PIVOT STUD
26	1	090-005-029	SOLENOID COVER
27	1	090-005-723	SOLENOID ASM, 115/230V 50/60Hz
28	1	710-501-012	GREASE FITTING, ALEMITE #1911B
29	2	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
30	2	809-865-205	HHCS 3/8-16 X 1.25 GR8 PB
31	2	809-865-245	HHCS 3/8-16 X 1.50 GR8 BO
32	2	813-933-162	HHMS 8-32 X 1.00 ZN
33	3	835-549-002	HFJN 1/4-20 ZN
34	1	835-557-002	HFJN 5/16-18 ZN
35	1	835-565-002	HFJN 3/8-16 ZN
36	1	835-570-002	HFJN 7/16-20 ZN
37	4	839-533-002	HLN 8-32 FLX CAD L/F
38	3	839-665-002	HLN 3/8-16 FLX CAD L/F
39	1	840-039-002	HLN 10-24 FLX CAD L/T
40	1	840-065-002	HLN 3/8-16 FLX CAD H/T
41	2	843-133-002	KN 8-32 ZN
42	2	844-049-002	HLN 1/4-20 CAD STV
43	1	844-065-002	HLN 3/8-16 CAD STV
44	1	880-139-200	SHSSB 1/4 X 0.88
45	1	900-204-121	BSH FS 0.25 X 0.38 X 0.75 BZ
46	3	900-208-041	BSH FS 0.50 X 0.63 X 0.25 BZ
47	1	900-210-251	BSH FS 0.63 X 0.88 X 0.31 BZ
48	1	901-100-110	CLLR SLD 0.50 X 1/4-20 ZN
49	3	907-000-200	KEY HP 0.13 X 0.53
50	2	913-415-100	PIN RL 0.09 X 0.63 NS
51	1	913-464-480	PIN RL 0.38 X 3.00 NS
52	4	948-637-072	FW 0.18 X 0.50 X 0.05 NS
53	3	963-200-002	RNG XW 0.130 X 0.055 NS SP

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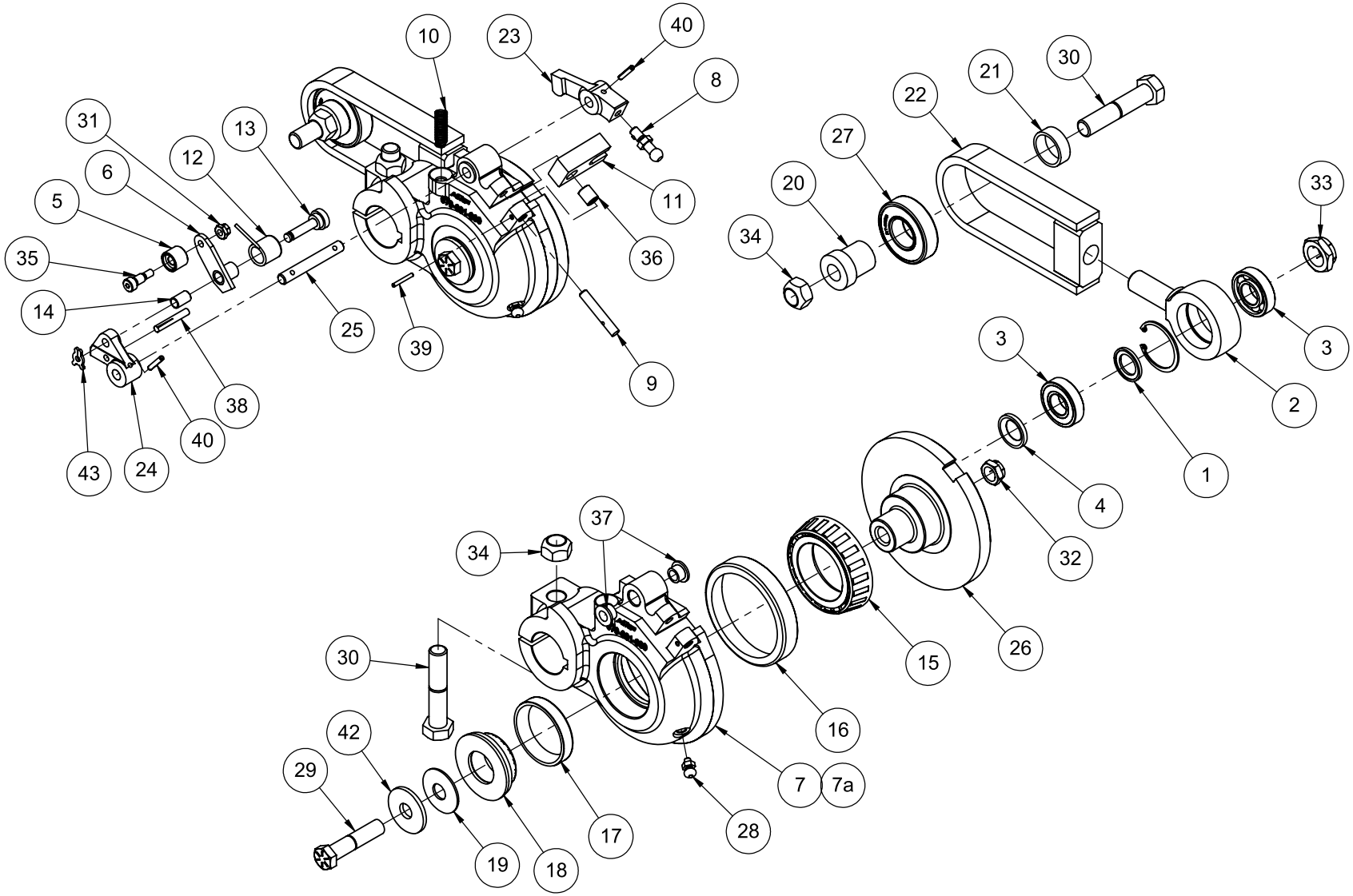

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ITEM	QTY	PART #	DESCRIPTION
1	1	000-021-878	SPACER
2	1	000-021-879	ROD END, TABLE DRIVE
3	2	000-021-881	BRG B 1E 0.63 X 1.38 X 0.34
4	1	070-001-849	FW 0.63 X 1.00 X 0.13 BO SP
5	1	070-001-857	ROLLER; ACTUATOR ASY
6	1	070-001-861	LINK & HUB ASM
7	1	070-001-889	CRANK HOUSING, TABLE DRIVE
7a	1	070-002-778	CRANK HOUSING & CUP ASSEMBLY
8	1	070-001-893	CAM BALL
9	1	070-001-894	PIN PIVOT
10	1	070-001-917	SPRING COMPRESSION LATCH ASM
11	1	070-001-918	LATCH
12	1	070-001-931	SPRING, TABLE DRIVE
13	1	070-001-932	PIN, ACTUATOR ASM
14	1	070-002-652	BSH SV 0.25 X 0.32 X 0.50 SL
15	1	070-002-776	CONE BRG, TABLE DRIVE
16	1	070-002-777	CUP ROLLER BRG, TABLE DRIVE
17	1	070-002-780	CUP ROLLER BRG, TABLE DRIVE
18	1	070-002-824	CONE & SEAL BRG ASM
19	1	070-006-729	BW 7/16 AM341215 NS
20	1	070-007-310	BUSHING, TABLE DRIVE ASM
21	1	070-007-311	SLEEVE, TABLE DR ASM

ITEM	QTY	PART #	DESCRIPTION
22	1	070-007-755	YOKE WLDMNT ASM
23	1	070-008-321	LATCH ARM
24	1	070-008-322	LINK, TABLE DRIVE ASM
25	1	070-008-325	PIN, ACTUATOR ASM
26	1	090-005-549	ECCENTRIC TABLE DRIVE
27	1	190-001-490	BRG B 2E .875X1.875X.50_R142RS
28	1	710-501-004	GREASE FITTING, ALEMITE #1641B
29	1	809-870-325	HHCS 7/16-20 X 2.00 GR8 PB
30	2	809-873-405	HHCS 1/2-13 X 2.50 GR8 PB
31	1	839-539-002	HLN 10-24 FLX CAD L/F
32	1	840-070-002	HLN 7/16-20 FLX CAD L/T
33	1	840-182-002	HLN 5/8-18 FLX CAD L/T
34	2	844-073-002	HLN 1/2-13 CAD STV
35	1	880-139-120	SHSSB 1/4 X 0.38
36	1	900-104-071	BSH SV 0.25 X 0.38 X 0.44 BZ
37	2	900-205-053	BSH FS 0.31 X 0.44 X 0.31 SS
38	1	912-137-200	PIN GR 0.19 X 1.25 NS 2
39	1	913-415-120	PIN RL 0.09 X 0.75 NS
40	2	913-423-120	PIN RL 0.13 X 0.75 NS
41	1	919-000-600	RNG SI 1.375 X 0.050 NS
42	1	949-071-227	FW 0.47 X 1.38 X 0.12 ZN
43	1	963-300-002	RNG XW 0.164 X 0.065 NS SP

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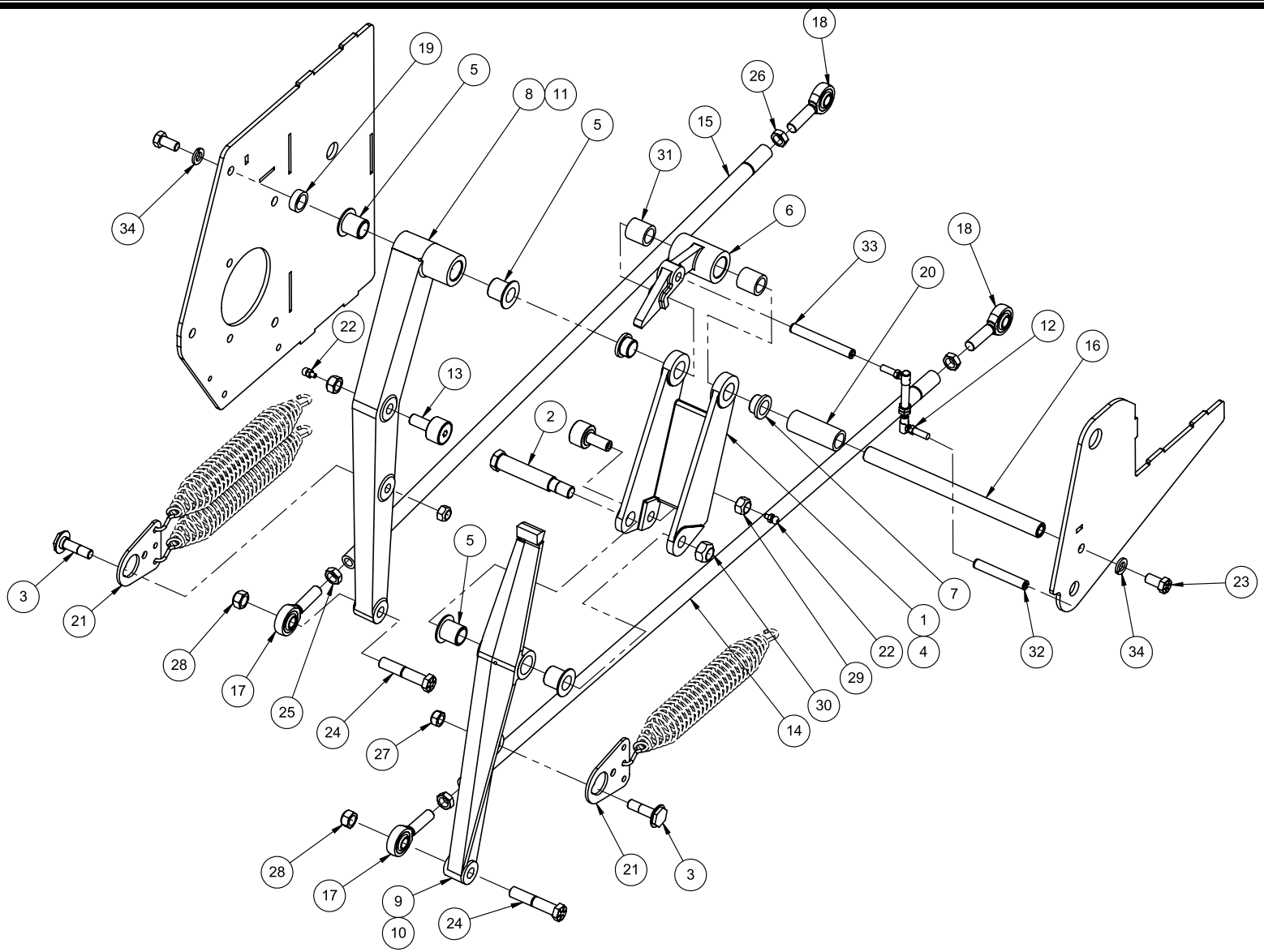

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1	1	070-001-565	ARM LINK, RESPOT
2	1	070-001-585	PIN, SPOT LINK
3	2	070-001-587	HHSB 3/8 X 1.38 BO SP
4	1	070-001-605	SPOT LINK ASM, UPPER (INCL. 1 & 7)
5	4	070-001-919	BSH FS 0.63 X 0.82 X 0.88 BZ
6	1	070-001-996	LATCH, SPOTTING ARM
7	2	070-002-691	BSH FX 0.63 X 0.75 X 0.50 BZ
8	1	070-006-459	LINK ARM, RESPOT
9	1	070-006-479	SPOT ARM LINK
10	1	070-006-481	LINK ARM ASM, SPOT (INCL. 5 & 9)
11	1	070-006-492	LINK ARM ASM, RESPOT (INCL. 5 & 8)
12	1	070-006-493	BALL JOINT ASM, SPOT LATCH
13	2	070-006-728	CAM FOLLOWER
14	1	088-005-501	SPOT TIE ROD ASM (incl. 17, 18, 25, 26)
15	1	088-005-500	RESPOT TIE ROD ASM (incl. 17, 18, 25, 26)
16	1	090-005-025	SHAFT, SPOT / RESPOT PIVOT
17	2	090-005-264	ROD END 7/16 RH
18	2	090-005-265	ROD END 7/16 LH
19	1	090-005-534	SFR 0.64 X 0.88 X 0.29 BO
20	1	090-005-564	SFR 0.64 X 0.88 X 2.29 BO
21	2	090-005-576	SPRING HANGER BRKT
22	2	710-501-012	GREASE FITTING, ALEMITE #1911B
23	2	809-865-125	HHCS 3/8-16 X 0.75 GR8 PB
24	2	809-869-365	HHCS 7/16-14 X 2.25 GR8 PB
25	2	835-570-002	HFJN 7/16-20 ZN
26	2	835-670-002	HFJN 7/16-20 ZN LH

ITEM	QTY	PART #	DESCRIPTION
27	2	844-065-002	HLN 3/8-16 CAD STV
28	2	844-069-002	HLN 7/16-14 CAD STV
29	2	844-070-002	HLN 7/16-20 CAD STV
30	1	844-073-002	HLN 1/2-13 CAD STV
31	2	900-110-141	BSH SV 0.63 X 0.88 X 0.88 BZ
32	1	913-464-400	PIN RL 0.38 X 2.50 NS
33	1	913-464-480	PIN RL 0.38 X 3.00 NS
34	2	951-164-002	SWM 3/8 ANSI NS

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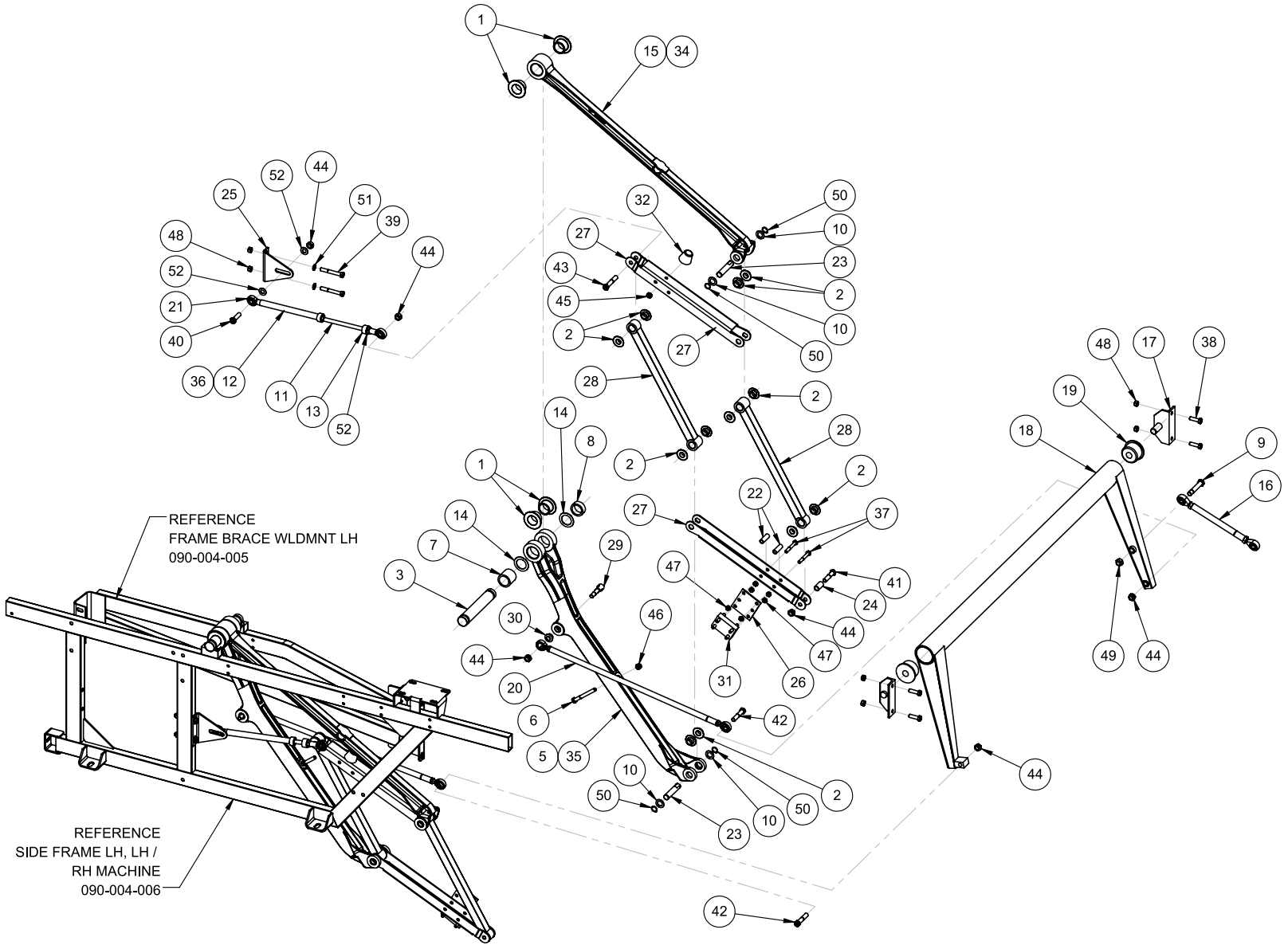

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ITEM	QTY	PART #	DESCRIPTION
1	4	000-023-104	BSH FS 1.25 X 1.50 X 0.94 SL
2	12	000-023-114	BSH FS 0.63 X 0.82 X 0.45 SL
3	1	070-003-106	MAIN PIVOT SHAFT
4	1	070-003-117	DRIVE LINK SPACER
5	1	070-003-157	LINK DRIVE, SWEEP
6	1	070-003-221	HHCS 3/8-16 X 3.50 GR8 2.5 PT
7	1	070-003-232	MAIN PIVOT SPACER, LONG
8	1	070-003-233	MAIN PIVOT SPACER, SHORT
9	1	070-003-245	HHCS 1/2-13 X 2.84 GR8 SP
10	4	070-006-121	FW 0.64 X 1.06 X 0.05 BO
11	1	070-007-276	ROD, TELESCOPING LINK ASM
12	1	070-007-278	TUBE WELD LINK ASM
13	1	070-007-283	BUMPER
14	2	070-011-819	FW 1.29 X 1.88 X 0.03 BO
15	1	088-000-093	LINK, SWEEP NO HOLE
16	1	088-001-353	TIE ROD ASM, SWEEP MOTOR
17	2	090-004-007	TORQUE TUBE HANGER
18	1	090-004-010	SWEEP TORQUE TUBE WELDMENT
19	2	090-005-015	TORQUE TUBE BEARING
20	1	090-005-254	DRIVE LINK CONNECTING ROD
21	1	090-005-257	ROD END 7/16 RH
22	2	090-006-125	SPACER LOWER STEEL SWEEP LINK
23	2	090-006-126	PIN, STEEL SWEEP LINKAGE
24	2	090-006-127	SFR 0.46 X 0.63 X 1.75
25	1	090-006-128	SWEEP LINK BRACKET
26	1	090-006-131	PLATE, SWEEP SHOCK MOUNT
27	2	090-006-132	STEEL SWEEP LINK
28	2	090-006-133	MIDDLE LINK, STEEL
29	1	090-006-134	DRIVE LINK PIN
30	1	090-006-135	DRIVE LINK BUSHING / SPACER
31	1	090-006-136	SHOCK MOUNT, SWEEP
32	1	090-006-137	BUMPER
33	1	090-006-138	ROD END 7/16 RH
34	1	090-006-139	STABLIZER LINK ASM (INCLUDES 14, 18, 20)
35	1	090-006-140	DRIVE LINK ASM (INCLUDES 14, 20, 24, 26,
36	1	090-006-145	TELESCOPE LINK ASM (INCLUDES 1, 3, 4, 6,
37	2	809-857-365	HHCS 5/16-18 X 2.25 GR8 BO
38	4	809-865-205	HHCS 3/8-16 X 1.25 GR8 PB
39	2	809-865-445	HHCS 3/8-16 X 2.75 GR8 PB
40	1	809-869-245	HHCS 7/16-14 X 1.50 GR8 PB
41	1	809-869-325	HHCS 7/16-14 X 2.00 GR8 PB
42	2	809-869-365	HHCS 7/16-14 X 2.25 GR8 PB
43	1	809-869-405	HHCS 7/16-14 X 2.50 GR8 PB
44	5	838-369-002	HLN 7/16-14 CAD RV
45	1	839-057-002	HLN 5/16-18 ZN NTU
46	1	839-665-002	HLN 3/8-16 FLX CAD L/F
47	6	844-057-002	HLN 5/16-18 CAD STV
48	6	844-065-002	HLN 3/8-16 CAD STV
49	1	844-073-002	HLN 1/2-13 CAD STV
50	4	919-005-600	RNG SE 0.625 X 0.035 NS
51	2	948-767-132	FW 0.41 X 0.73 X 0.06 ZN
52	3	948-868-162	FW 7/16 SAE NS

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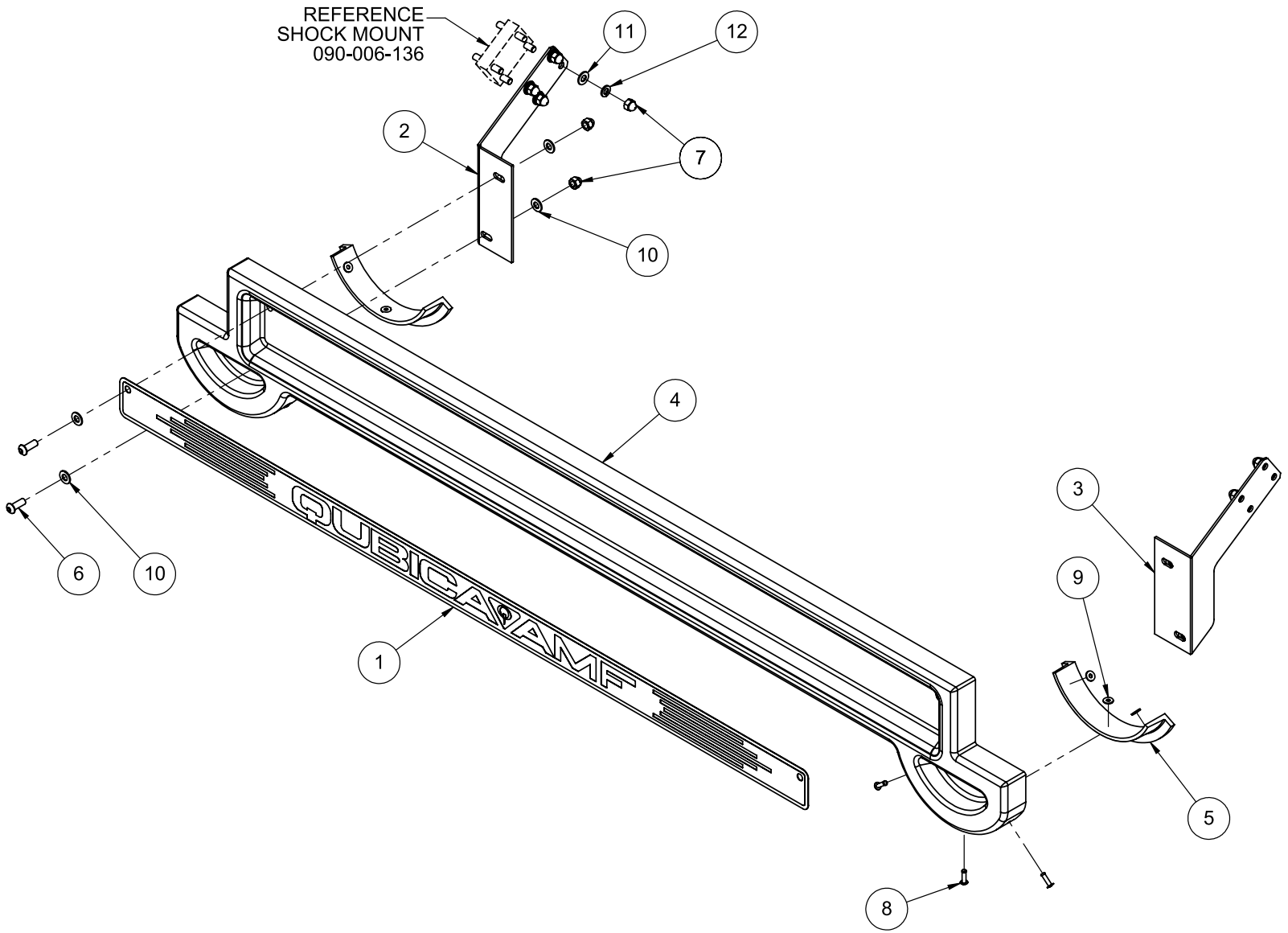

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ITEM	QTY	PART #	DESCRIPTION
1	1	088-001-089	QAMF 90XLi SWEEP DECAL
2	1	090-006-129	SWEEP BRKT, STEEL, 7PIN SIDE
3	1	090-006-130	SWEEP BRKT, STEEL, 10PIN SIDE
4	1	300-000-165	SWEEP BAR
5	2	300-000-175	SWEEP BAR CAP
6	4	808-557-140	BHSCS 5/16-18 X 0.88 BO
7	12	830-057-002	HACN 5/16-18 ZN LK LC
8	6	938-637-100	RVT BLD 0.19 X 0.80 AL
9	6	948-637-072	FW 0.18 X 0.50 X 0.05 NS
10	8	948-722-111	FW 5/16 SAE BO
11	8	948-761-112	FW 5/16 SAE NS
12	8	951-156-002	SWM 5/16 ANSI BO

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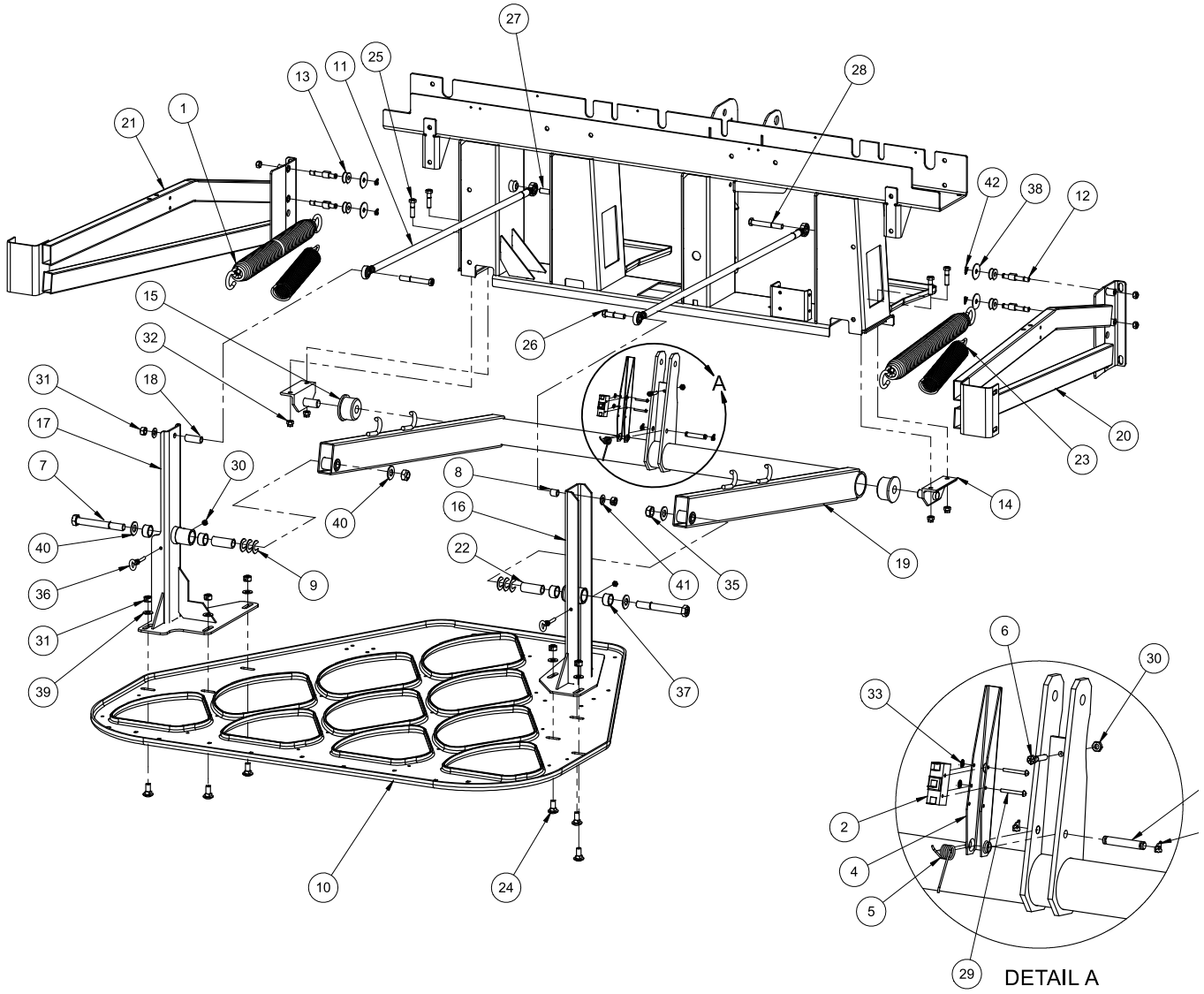

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ITEM	QTY	PART #	DESCRIPTION
1	2	000-022-782	SPRING, COUNTERBALANCE
2	1	000-026-042	SWITCH MICRO
3	1	070-001-591	PIN
4	1	070-001-852	OFF SPOT LEVER
5	1	070-001-853	SPRING
6	1	070-001-854	ADJUSTMENT SCREW
7	2	070-006-048	HHCS 5/8-11 X 5.00 GR8
8	1	070-007-303	SFR 0.46 X 0.63 X 0.64 BO
9	6	070-007-752	STW 0.64 X 1.25 X 0.06 BO
10	1	088-005-502	STEEL TABLE
11	2	088-005-540	STL TBL LEVELING TIE ROD
12	4	090-002-028	PIN SPRING ROLLER
13	4	090-003-795	SPRING ROLLER
14	2	090-004-007	TUBE HANGER WLDMNT
15	2	090-005-015	TORQUE TUBE BEARING
16	1	090-005-509	TABLE SPPRT WLDMT, 7 SIDE
17	1	090-005-514	TABLE SPPRT WLDMT, 10 SIDE
18	1	090-005-597	SFR 0.46 X 0.63 X 1.63 BO
19	1	088-005-538	STEEL TABLE TORQUE TUBE
20	1	090-005-646	LH FRAME BRACE WLDMT
21	1	090-005-647	RH FRAME BRACE WLDMT
22	2	090-005-654	SFR 0.63 X 0.87 X 2.16 BO
23	2	090-005-662	SPRING, SMALL COUNTERBALANCE
24	6	801-369-161	CB 7/16-14 X 1.00 GR5 BO
25	4	809-865-245	HHCS 3/8-16 X 1.50 GR8 BO
26	1	809-869-325	HHCS 7/16-14 X 2.00 GR8 PB
27	1	809-869-365	HHCS 7/16-14 X 2.25 GR8 PB
28	2	809-869-520	HHCS 7/16-14 X 3.25 GR8 BO
29	2	818-227-202	RHPMS 6-32 X 1.25 ZN SEMS
30	3	835-549-002	HFJN 1/4-20 ZN
31	10	838-369-002	HLN 7/16-14 CAD RV
32	4	839-665-002	HLN 3/8-16 FLX CAD L/F
33	2	843-127-002	KN 6-32 ZN
34	4	844-065-002	HLN 3/8-16 CAD STV
35	2	844-081-002	HLN 5/8-11 CAD STV
36	2	879-849-487	YB 1/4-20 X 3.00
37	4	900-114-101	BSH SV 0.88 X 1.13 X 0.63 BZ
38	4	945-867-242	FW 0.41 X 1.50 X 0.06 ZN
39	6	947-271-967	FW 7/16 SAE ZY
40	4	948-983-212	FW 5/8 SAE NS
41	2	949-100-002	FW 7/16 SAE NS
42	6	963-400-002	RNG XW 0.190 X 0.065 NS SP

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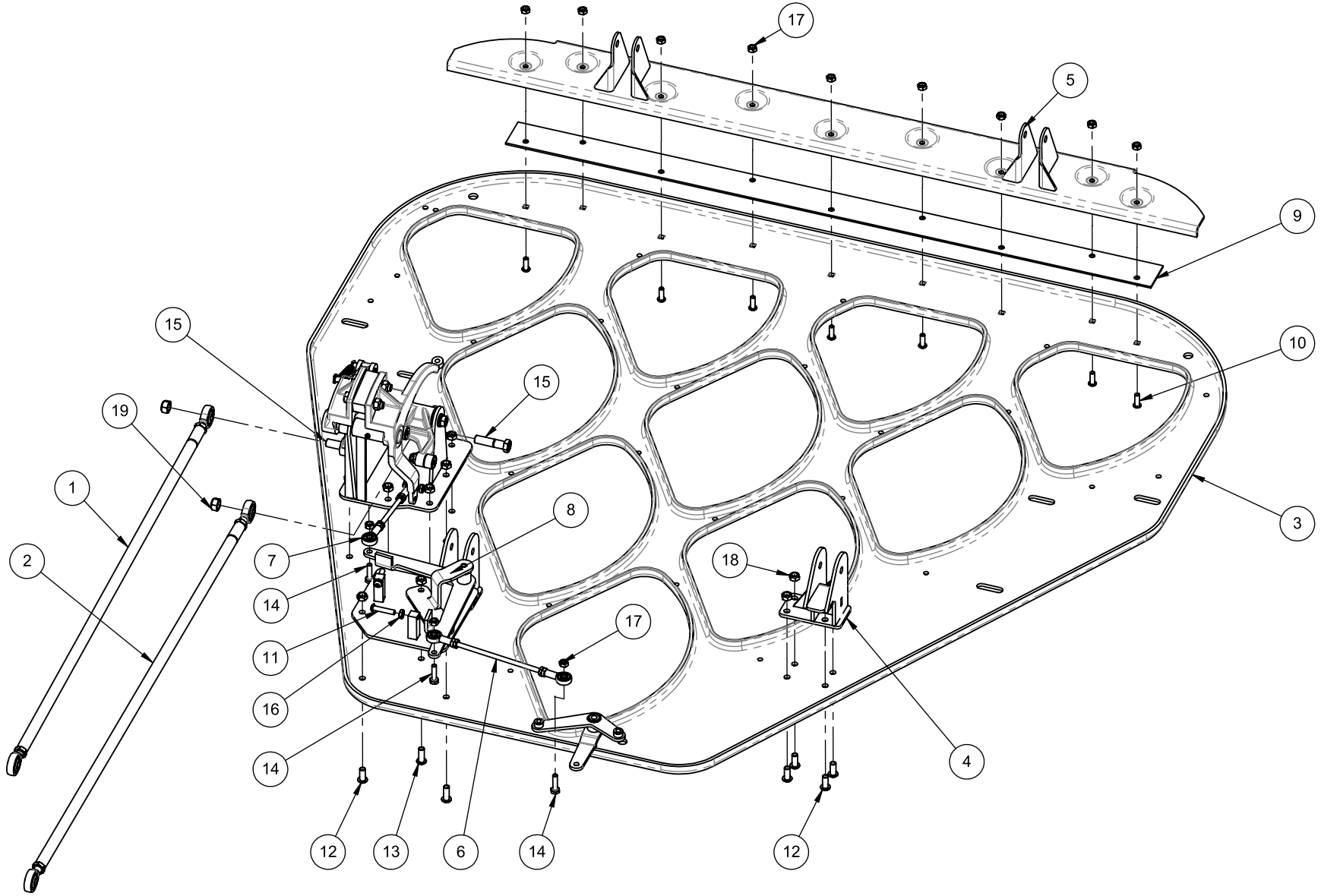

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ITEM	QTY	PART #	DESCRIPTION
1	1	088-005-500	RESPOT TIE ROD ASM
2	1	088-005-501	SPOT TIE ROD ASM
3	1	088-005-502	STEEL TABLE
4	2	090-005-505	FRONT BRACKET, TABLE
5	1	090-005-536	REAR MTG BRKT WLDMT
6	1	090-005-613	ROD ASSEMBLY LONG
7	1	090-005-615	ROD ASSEMBLY SHORT
8	1	090-005-637	PIVOT SUPPORT
9	1	090-005-656	SHIM
10	9	808-549-120	BHSCS 1/4-20 X 0.75 BO
11	2	808-549-200	BHSCS 1/4-20 X 1.25 BO
12	16	808-557-120	BHSCS 5/16-18 X 0.75 BO
13	2	808-557-140	BHSCS 5/16-18 X 0.88 BO
14	4	809-849-165	HHCS 1/4-20 X 1.00 GR8 BO
15	2	809-869-285	HHCS 7/16-14 X 1.75 GR8 PB
16	2	835-549-002	HFJN 1/4-20 ZN
17	13	844-049-002	HLN 1/4-20 CAD STV
18	18	844-057-002	HLN 5/16-18 CAD STV
19	2	844-069-002	HLN 7/16-14 CAD STV

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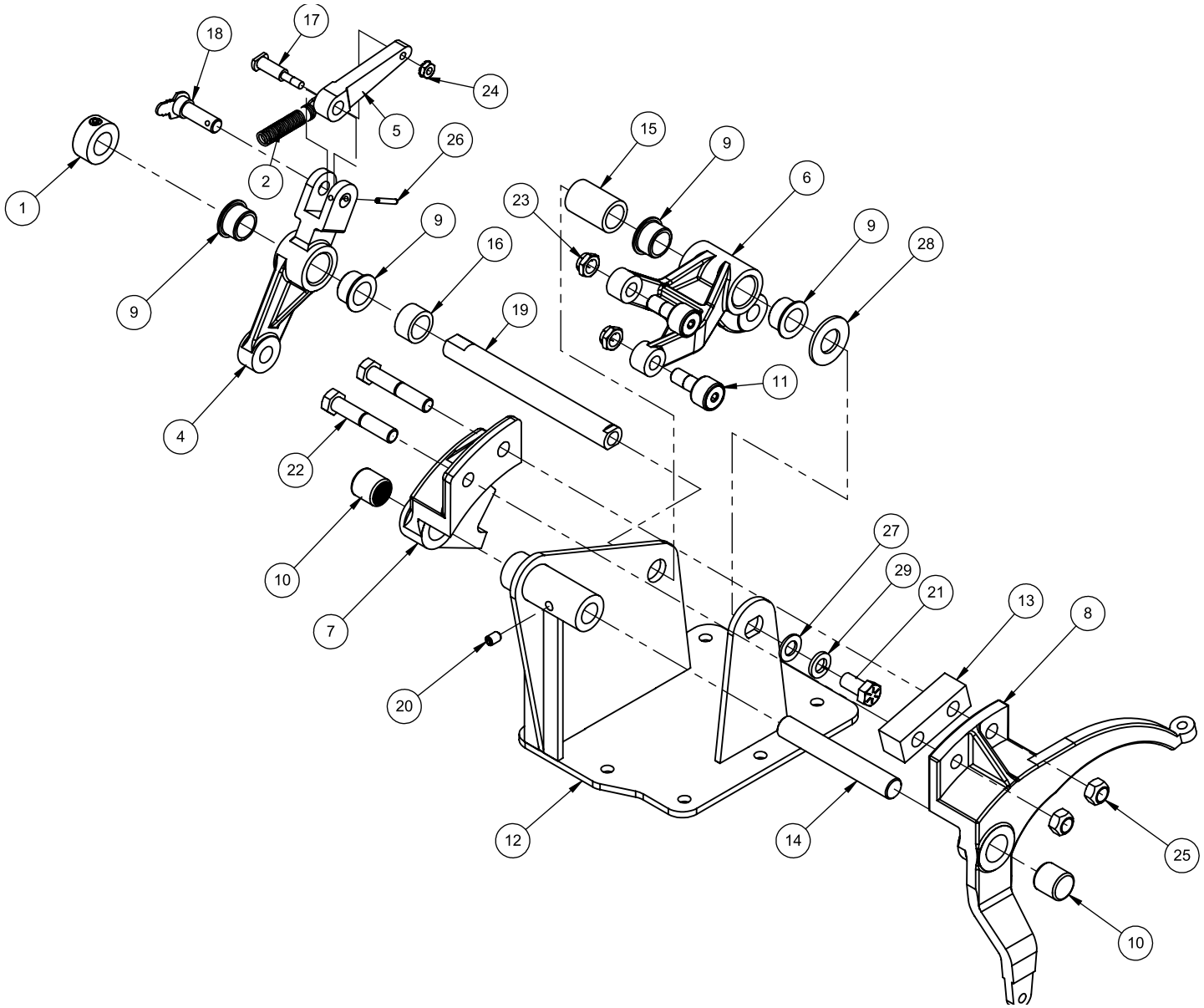

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ITEM	QTY	PART #	DESCRIPTION
1	1	000-021-423	CLLR SLD 0.63 X 5/16-18 ZN
2	1	070-001-807	RESPOT FINGER SPRING
3	-	070-002-589	FINGER LEVER
4	1	070-002-579	FINGER LEVER
5	1	070-002-590	FINGER LINK
6	1	070-002-599	LEVER
7	1	070-002-724	SHIFTER LINK
8	1	070-002-725	CAM LINK
9	4	070-002-745	BSH FS 0.63 X 0.81 X 0.50 BZ
10	2	070-002-781	NEEDLE BEARING CAM LINK TABLE
11	2	070-002-816	CAM FOLLOWER
12	1	088-005-503	TIE ROD BRACKET WELDMENT
13	1	090-005-520	SPACER, LEVER
14	1	090-005-521	SHAFT, SHORT SIDE
15	1	090-005-532	SPACER
16	1	090-005-533	SPACER
17	1	090-005-629	PIN
18	1	090-005-631	PIVOT WLDMT, RESPOT FINGER
19	1	090-005-655	SHAFT, TIE ROD BRACKET
20	1	807-249-060	SSS 1/4-20 X 0.38 CUP BO PA
21	1	809-865-125	HHCS 3/8-16 X 0.75 GR8 PB
22	2	809-865-325	HHCS 3/8-16 X 2.00 GR8 PB
23	2	840-066-002	HLN 3/8-24 FLX CAD L/T
24	1	843-140-002	KN 10-32 ZN
25	2	844-065-002	HLN 3/8-16 CAD STV
26	1	913-423-120	PIN RL 0.13 X 0.75 NS
27	1	948-767-132	FW 0.41 X 0.73 X 0.06 ZN
28	1	948-983-212	FW 5/8 SAE NS
29	1	951-164-002	SWM 3/8 ANSI NS

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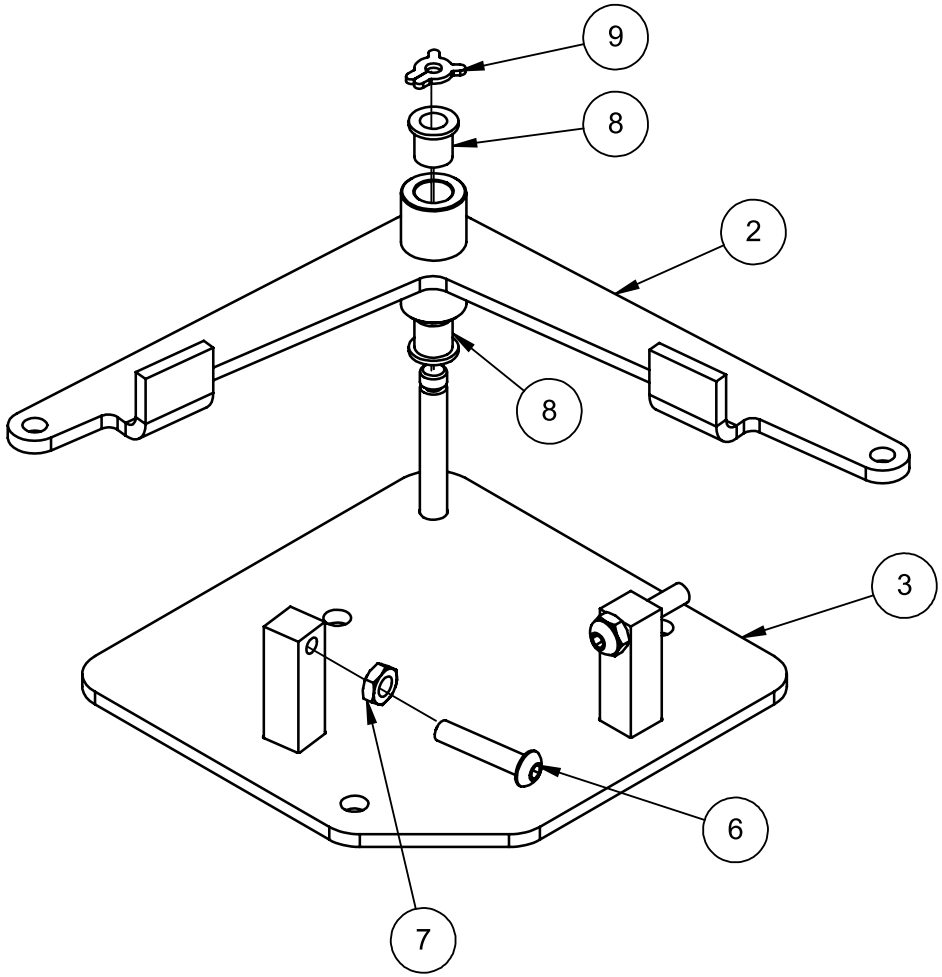

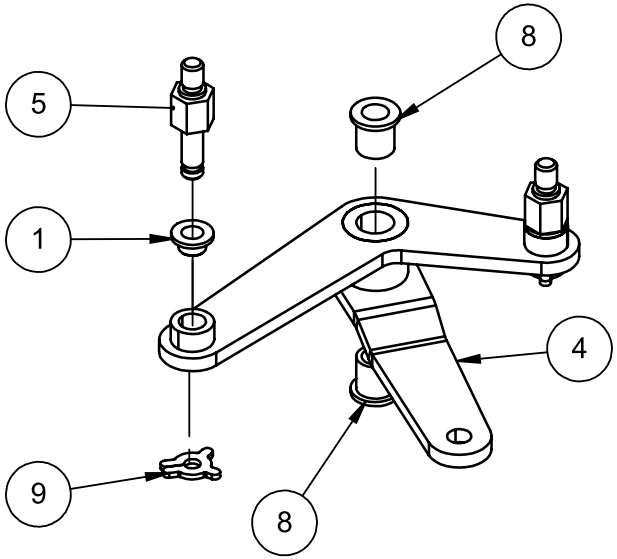

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1	4	070-002-630	BSH FS 0.25 X 0.32 X 0.22 BZ
2	1	090-005-600	ACTUATOR LEVER WELDMENT
3	1	090-005-603	BASE PLATE WELDMENT, ACTUATOR
4	1	090-005-607	FRONT CONNECTING LINK WELDMENT
5	2	090-005-612	PIN 8, 9. 10 LINK
6	2	808-549-200	BHSCS 1/4-20 X 1.25 BO
7	2	835-549-002	HFJN 1/4-20 ZN
8	4	900-205-081	BSH FS 0.31 X 0.44 X 0.50 BZ
9	3	963-400-002	RNG XW 0.190 X 0.065 NS SP

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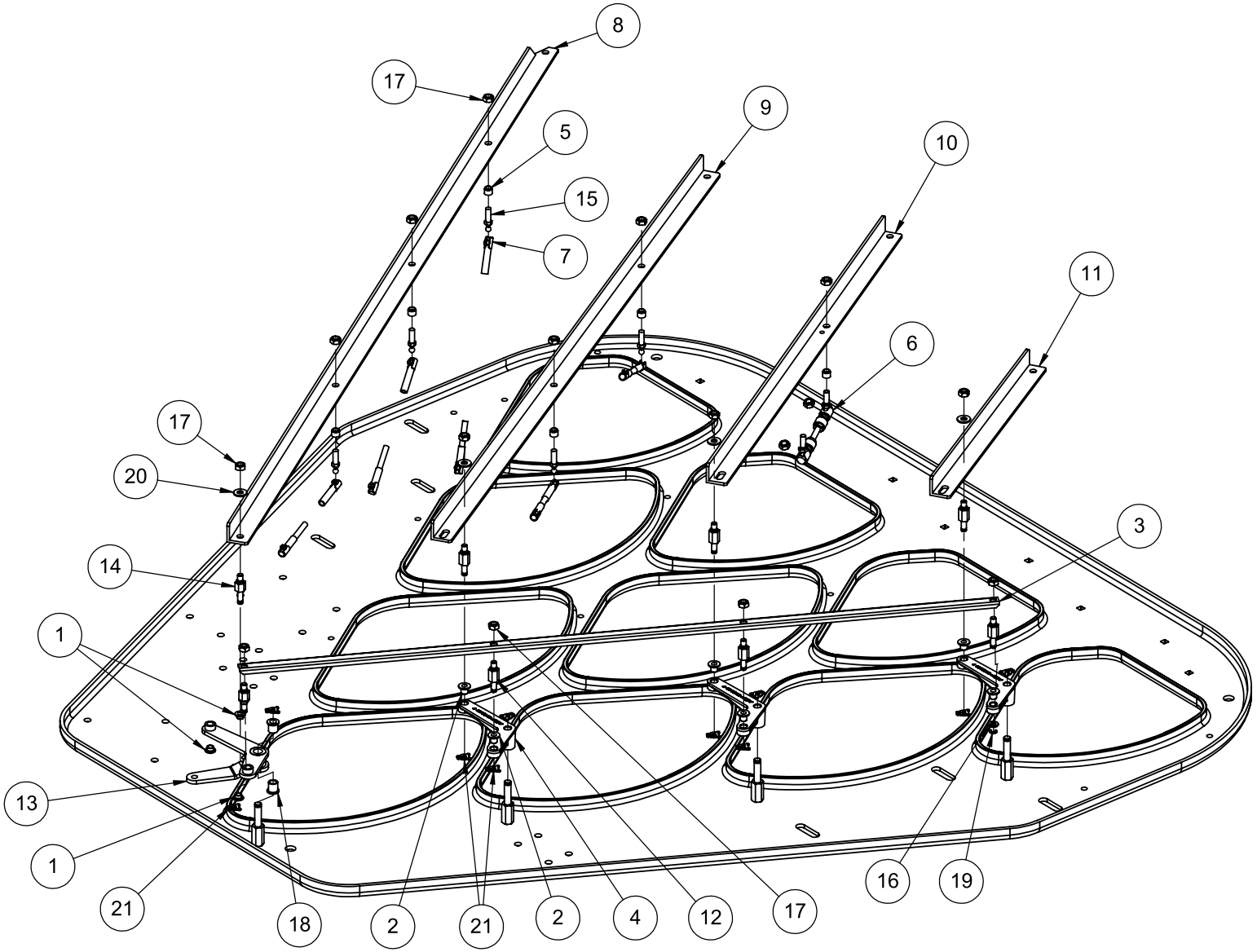

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1	4	070-002-630	BSH FS 0.25 X 0.32 X 0.22 BZ
2	6	070-002-653	BSH FS 0.25 X 0.32 X 0.38 BZ
3	1	070-002-671	RESPOT CONNECTING LINK
4	3	070-002-678	LEVER, RESPOT
5	6	070-002-815	SPACER BUSHING
6	1	088-005-532	6 PIN LINK ASM
7	5	090-002-020	LINK BODY
8	1	090-005-555	7 PIN LINK
9	1	090-005-556	8 PIN LINK
10	1	090-005-557	9 PIN LINK
11	1	090-005-558	10 PIN LINK
12	6	090-005-571	PIN 8-9-10 LINKS
13	1	090-005-607	FRONT LINK CONNECTOR WLDMT
14	2	090-005-612	PIN FRONT CONNECTOR LINK
15	5	730-027-019	STUD
16	1	785-502-207	FW M6 DIN BO
17	27	844-049-002	HLN 1/4-20 CAD STV
18	2	900-205-081	BSH FS 0.31 X 0.44 X 0.50 BZ
19	1	919-001-450	RNG E 0.219 X 0.025 PH RIN
20	4	948-753-102	FW 1/4 SAE NS
21	11	963-400-002	RNG XW 0.190 X 0.065 NS SP

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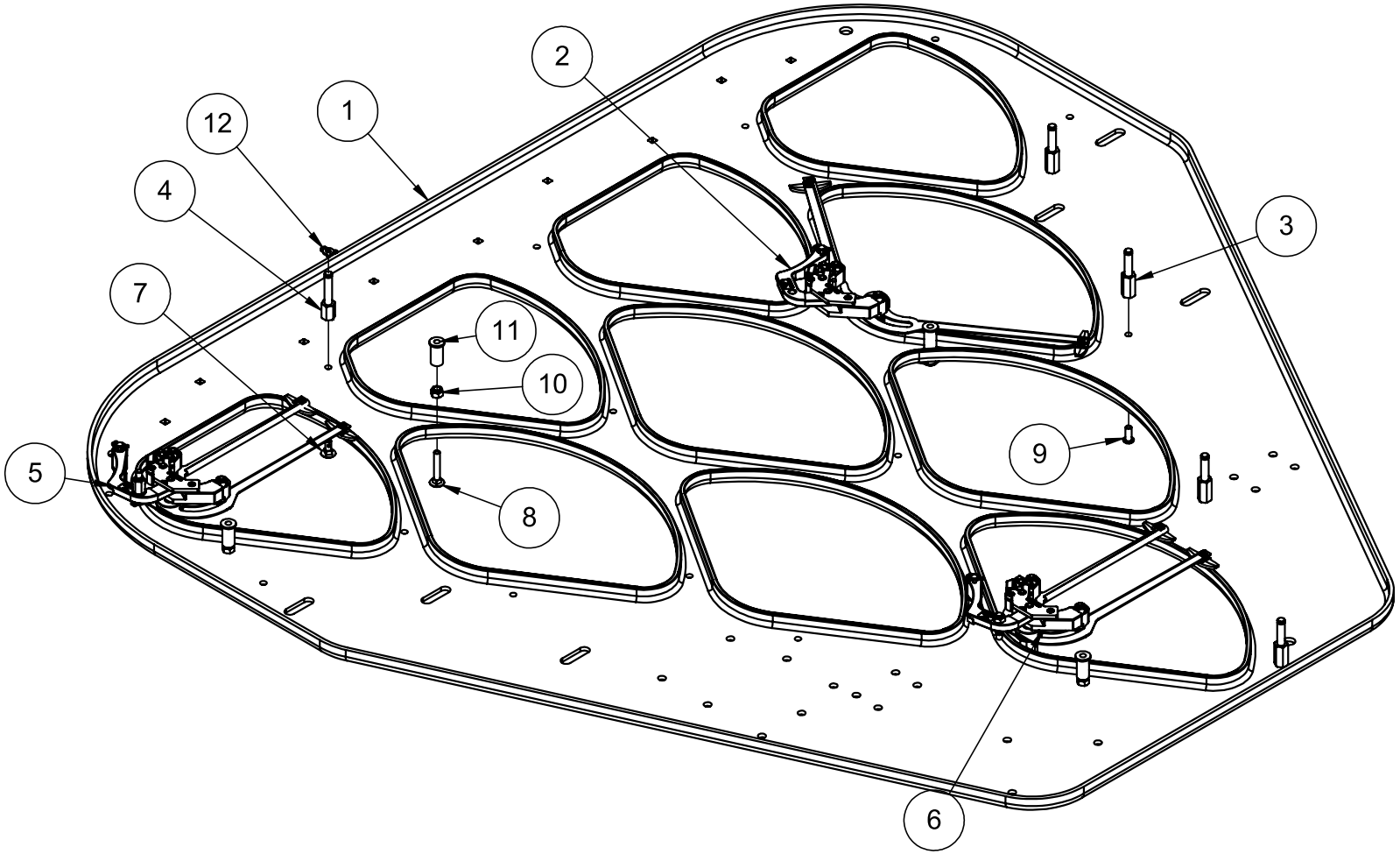

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ITEM	QTY	PART #	DESCRIPTION
1	1	088-005-502	STEEL TABLE
2	1	088-005-513	RESPOT CELL ASM, 6
3	4	090-005-503	LINK, CONNECTOR PIVOT
4	10	090-005-504	RESPOT PIVOT
5	4	090-005-540	RESPOT CELL ASM, 7-10
6	5	090-005-544	RESPOT CELL ASM, 1-6
7	10	801-149-100	CB 1/4-20 X 0.63 GR5 ZN PA
8	10	801-149-247	CB 1/4-20 X 1.50 GR5 ZN
9	4	809-149-100	BHSCS 1/4-20 X 0.63 BO PA
10	10	838-549-002	HLN 1/4-20 ZN NE
11	10	855-349-010	WELL NUT, 1/4-20 X 1.00
12	10	963-400-002	RNG XW 0.190 X 0.065 NS SP

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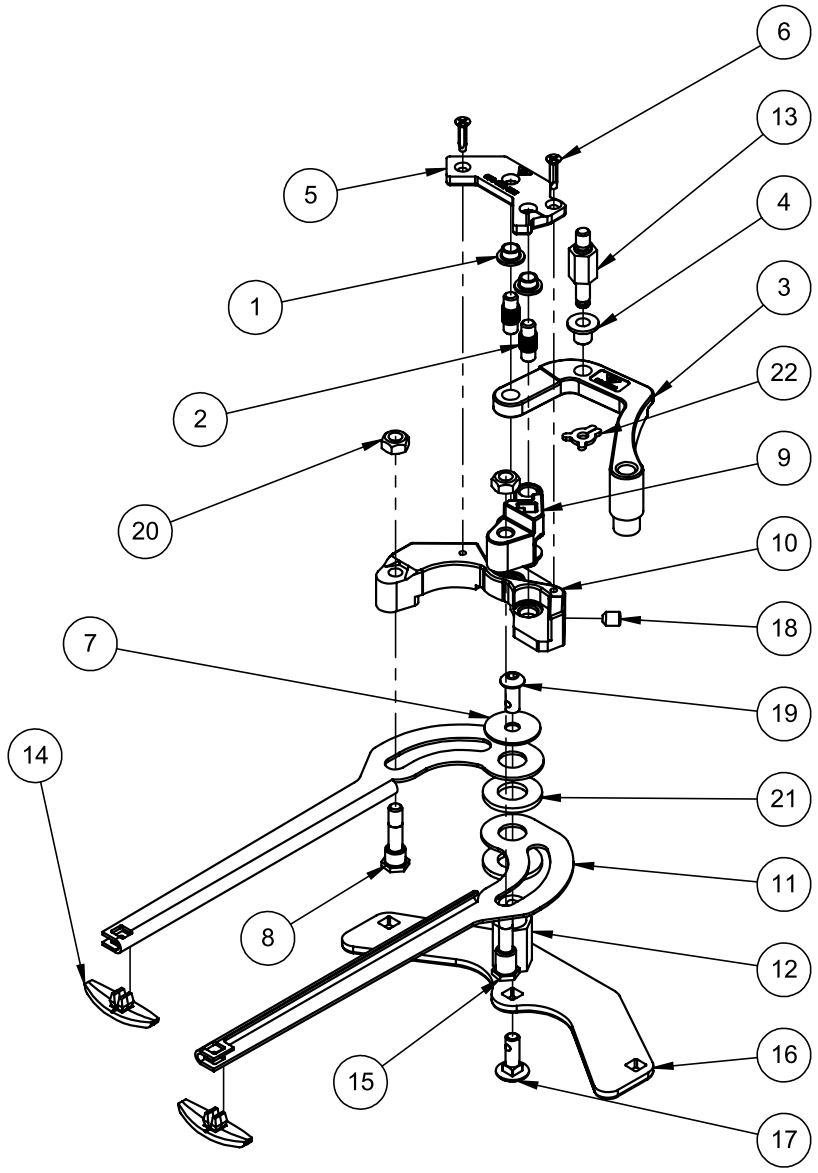

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1	4	070-002-630	BSH FS 0.25 X 0.32 X 0.22 BZ
2	2	070-002-645	SHAFT - YOKE
3	1	070-002-651	LEVER RESPOT YOKE PIVOT
4	1	070-002-653	BSH FS 0.25 X 0.32 X 0.38 BZ
5	1	070-002-695	YOKE PLATE
6	2	070-002-750	FHPTS 6-32 X 0.63 ZN SP
7	1	070-007-192	FW 0.27 X 1.00 X 0.05 ZN
8	1	070-007-195	STUD SHORT, RESPOT CELL
9	1	090-004-113	ARM, RESPOT YOKE
10	1	090-004-118	RESPOT YOKE
11	2	090-004-119	RESPOT CELL FINGER
12	1	090-005-522	BUSHING
13	1	090-005-571	PIN 8-9-10 LINKS
14	2	090-005-617	FINGER INSERT
15	1	090-005-640	STUD LONG, RESPOT CELL STL TBL
16	1	090-005-663	FINGER PIVOT WING II
17	1	801-149-127	CB 1/4-20 X 0.75 GR8 ZN PA
18	1	807-650-050	SSS 1/4-28 X 0.31 FLT BO PA
19	1	809-149-100	BHSCS 1/4-20 X 0.63 BO PA
20	2	844-049-002	HLN 1/4-20 CAD STV
21	2	948-975-172	FW 0.53 X 1.06 X .10 NS
22	1	963-400-002	RNG XW 0.190 X 0.065 NS SP

ITEM	QTY	PART #	DESCRIPTION

WORLDWIDE HEADQUARTERS
8100 AMF Drive - Mechanicsville, Va 23111 - USA
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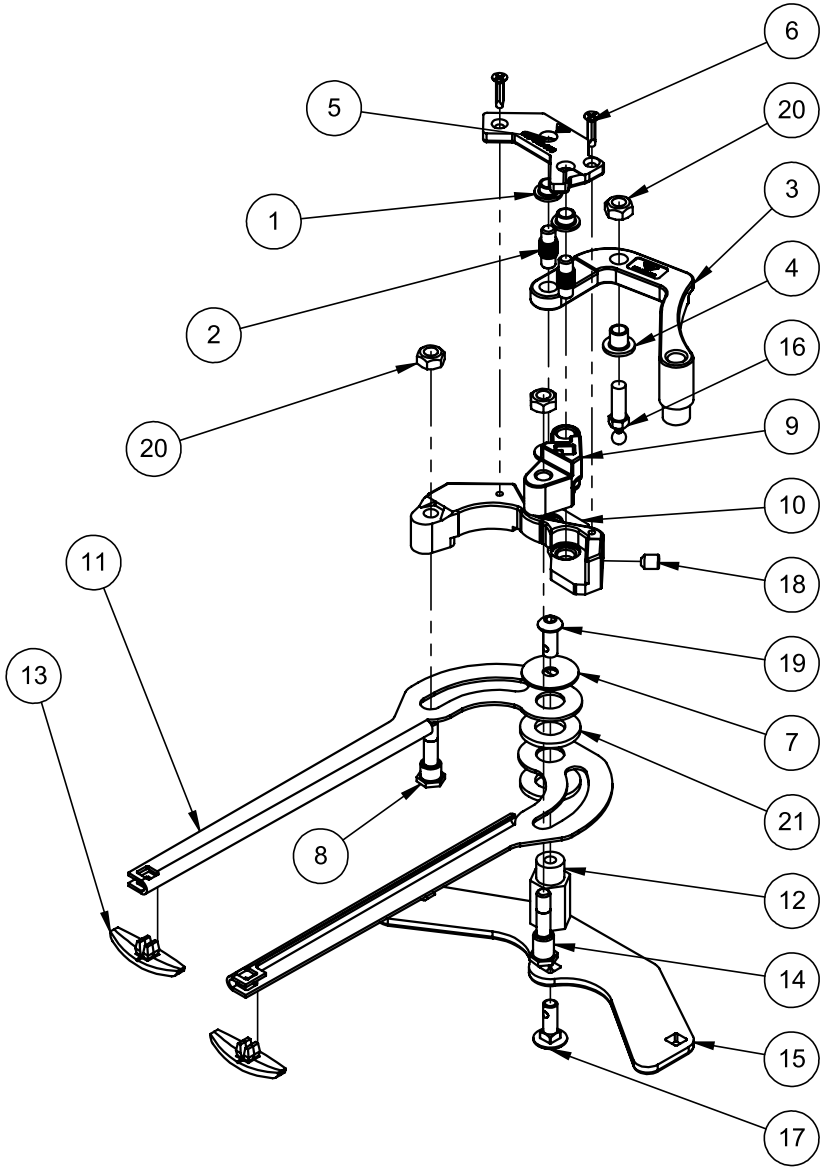

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ITEM	QTY	PART #	DESCRIPTION
1	4	070-002-630	BSH FS 0.25 X 0.32 X 0.22 BZ
2	2	070-002-645	SHAFT - YOKE
3	1	070-002-651	LEVER RESPOT YOKE PIVOT
4	1	070-002-653	BSH FS 0.25 X 0.32 X 0.38 BZ
5	1	070-002-695	YOKE PLATE
6	2	070-002-750	FHPTS 6-32 X 0.63 ZN SP
7	1	070-007-192	FW 0.27 X 1.00 X 0.05 ZN
8	1	070-007-195	STUD SHORT, RESPOT CELL
9	1	090-004-113	ARM, RESPOT YOKE
10	1	090-004-118	RESPOT YOKE
11	2	090-004-119	RESPOT CELL FINGER
12	1	090-005-522	BUSHING
13	2	090-005-617	FINGER INSERT
14	1	090-005-640	STUD LONG, RESPOT CELL STL TBL
15	1	090-005-663	FINGER PIVOT WING II
16	1	730-027-019	STUD
17	1	801-149-127	CB 1/4-20 X 0.75 GR8 ZN PA
18	1	807-650-050	SSS 1/4-28 X 0.31 FLT BO PA
19	1	809-149-100	BHSCS 1/4-20 X 0.63 BO PA
20	3	844-049-002	HLN 1/4-20 CAD STV
21	2	948-975-172	FW 0.53 X 1.06 X .10 NS

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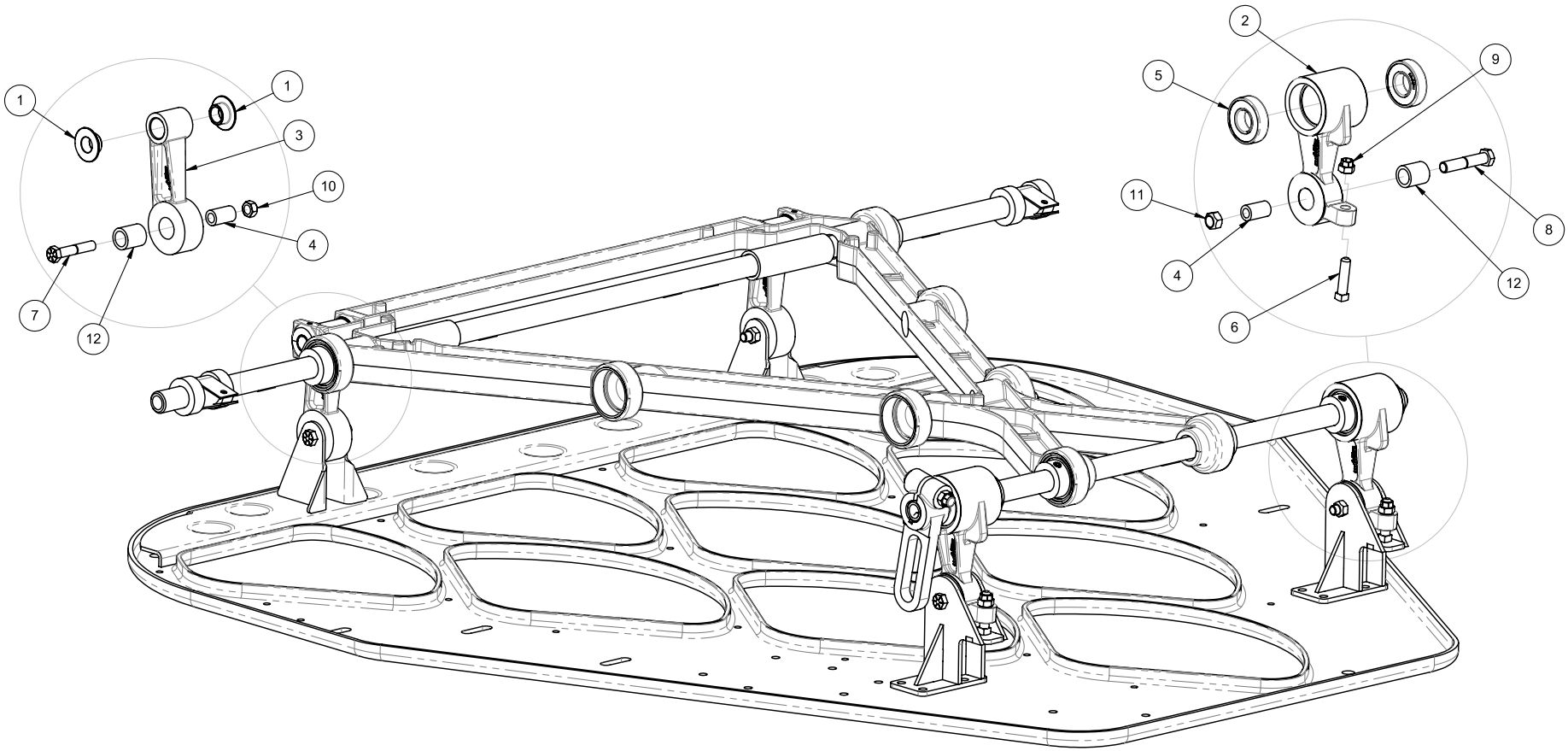

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ITEM	QTY	PART #	DESCRIPTION
1	6	000-023-114	BSH FS 0.63 X 0.82 X 0.45 SL
2	3	090-005-546	FRONT YOKE LEG
3	3	090-005-547	REAR YOKE LEG
4	6	090-005-593	SFR 0.39 X 0.63 X 1.06 BO
5	10	190-001-490	BRG B 2E .875X1.875X.50_R142RS
6	3	806-265-240	QHSS 3/8-16 X 1.50 CUP BO
7	1	809-865-325	HHCS 3/8-16 X 2.00 GR8 PB
8	1	809-869-365	HHCS 7/16-14 X 2.25 GR8 PB
9	4	839-665-002	HLN 3/8-16 FLX CAD L/F
10	1	844-065-002	HLN 3/8-16 CAD STV
11	1	844-069-002	HLN 7/16-14 CAD STV
12	6	900-110-161	BSH SV 0.63 X 0.88 X 1.00 BZ

ITEM	QTY	PART #	DESCRIPTION

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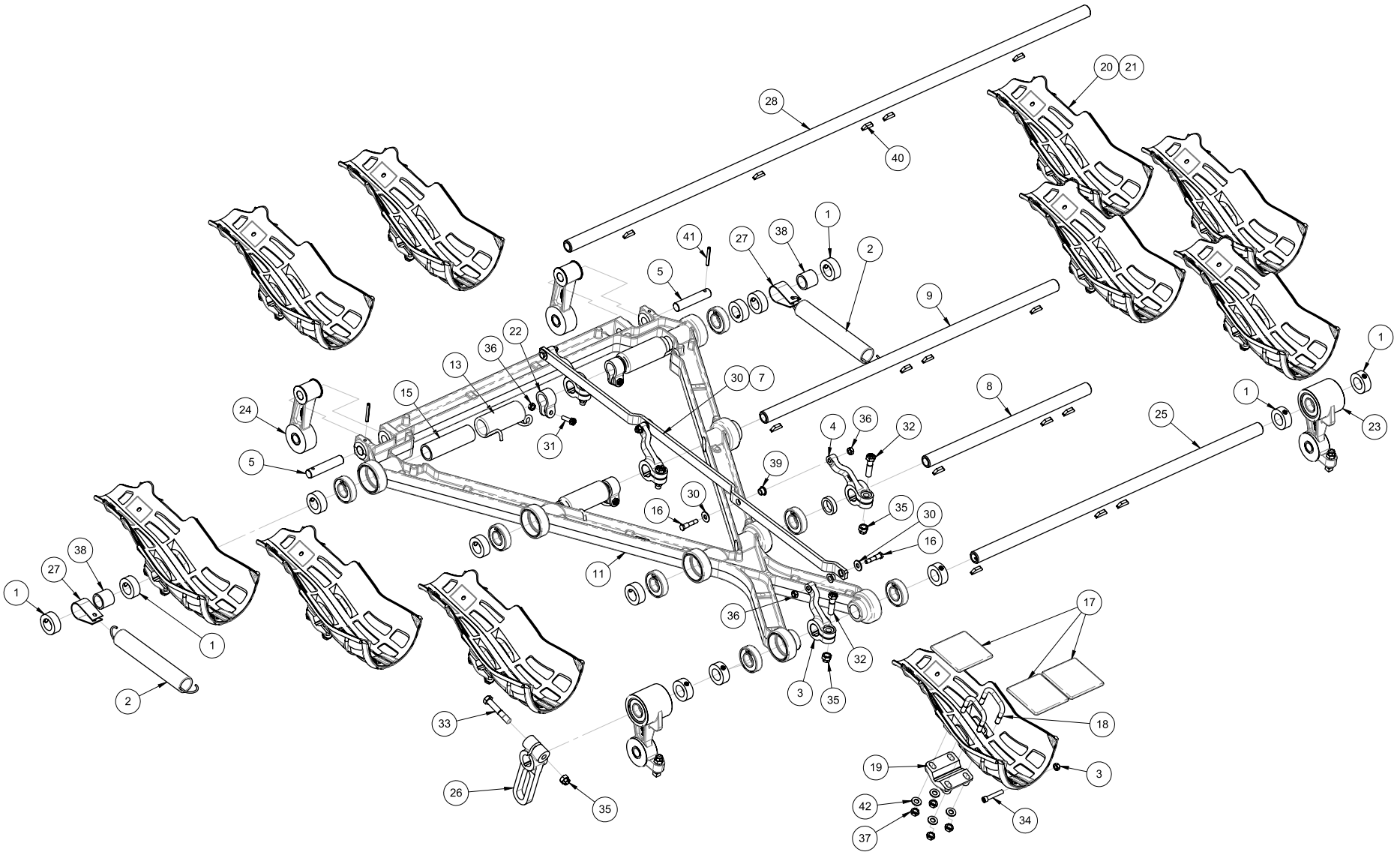

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ITEM	QTY	PART #	DESCRIPTION
1	14	000-025-549	CLLR SLD 0.88 X 5/16-18 ZN
2	2	000-026-032	SPRING, DIST LATERAL DRIVE
3	2	070-002-602	LEVER, INNER YOKE
4	2	070-002-603	LEVER, OUTER YOKE
5	2	070-002-609	PIN LEVER REAR YOKE ASM
6	1	070-002-611	LINK
7	1	070-002-612	TIE LINK ASM
8	1	070-002-616	SHAFT #2
9	1	070-002-617	SHAFT #3
10	1	070-002-620	SFR 0.88 X 1.25 X 0.31 BO
11	1	070-002-623	YOKE & BEARING ASM
13	2	070-002-688	SPRG, RH WOUND, LH SIDE
14	1	070-002-689	SPRG, LH WOUND, RH SIDE
15	3	070-002-719	SPRING SLEEVE
16	4	070-002-723	HHSB 1/4-20 X 0.85 BO
17	30	070-002-784	SPOTTING CUP LINER
18	20	070-002-787	U-BOLT
19	10	070-002-788	SPOTTING CUP CAP
20	10	070-002-808	SPOTTING CUP ASM
21	10	070-002-809	SPOTTING CUP
22	3	090-004-033	CMP CBL 0.89 X 0.75 ZN SP
23	2	090-005-545	FRONT LEG ASM
24	2	090-005-548	REAR LEG ASM
25	1	090-005-553	SHAFT #1
26	1	090-005-554	ARM, ACTUATOR
27	2	090-005-577	SPRING RETAINER

ITEM	QTY	PART #	DESCRIPTION
28	1	090-005-578	SHAFT #4
29	8	190-001-490	BALL BEARING, .875 X 1.875 X .5
30	4	701-310-036	BRG TH 0.31 X 0.75 X 0.06 SL
31	3	809-849-165	HHCS 1/4-20 X 1.00 GR8 BO
32	4	809-865-245	HHCS 3/8-16 X 1.50 GR8 BO
33	1	809-865-365	HHCS 3/8-16 X 2.25 GR8 PB
34	10	810-249-240	SCREW, SOCKET HEAD, 1/4-20 X 1-1/2
35	5	839-665-002	HLN 3/8-16 FLX CAD L/F
36	17	844-049-002	HLN 1/4-20 CAD STV
37	40	844-057-002	HLN 5/16-18 CAD STV
38	2	900-114-161	BSH SV 0.88 X 1.13 X 1.00 BZ
39	4	900-205-053	FLANGED BEARING .3155 X .625 X .312
40	15	907-000-600	KEY HP 0.19 X 0.88
41	2	913-437-240	PIN RL 0.19 X 1.50 NS
42	40	948-761-112	FW 5/16 SAE NS

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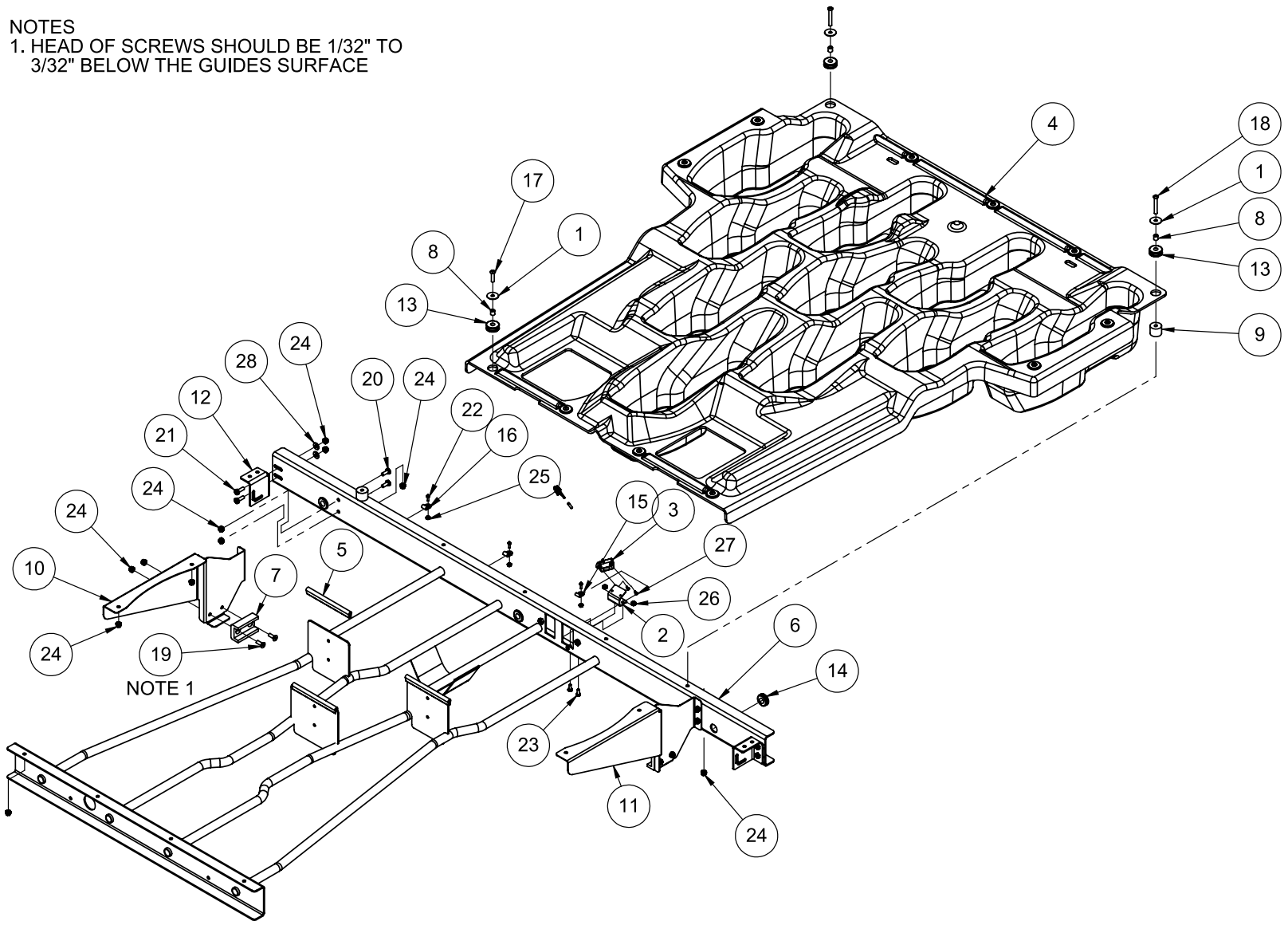
NOTES
1. HEAD OF SCREWS SHOULD BE 1/32" TO 3/32" BELOW THE GUIDES SURFACE



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ITEM	QTY	PART #	DESCRIPTION
1	13	070-007-192	FW 0.27 X 1.00 X 0.05 ZN
2	1	088-000-226	DBII OP SW BRKT
3	1	088-000-245	BIN SW OPTICAL SENSOR ASM
4	1	088-000-259	DBII, BSO
5	3	088-001-264	BIN FRAME EDGE TRIM
6	1	088-001-601	DURABIN II FRAME WELDMENT
7	2	088-001-603	SHUTTLE REAR SUPPORT GUIDE
8	13	088-001-604	SFR 0.26 X 0.38 X 0.38 ZN
9	2	088-001-605	HAT REPLACEMENT SPACER
10	1	088-001-607	DB II SHUTTLE SPPRT, 7 SIDE
11	1	088-001-610	DB II SHUTTLE SPPRT, 10 SIDE
12	2	088-001-634	DBII REAR SAFETY SPT BRKT
13	13	711-512-040	GPI 0.38 X 0.88 X 0.25 RB 1
14	3	711-516-020	GPI 0.50 X 0.81 X 0.13 RB 1
15	1	744-107-013	CMP CBL 0.13 X 0.50 NY
16	2	744-107-016	CMP CBL 0.19 X 0.50 NY
17	11	808-549-160	BHSCS 1/4-20 X 1.00 BO
18	2	808-549-285	BHSCS 1/4-20 X 1.75 BO
19	4	808-849-120	FHSCS 1/4-20 X 0.75 BO
20	4	809-849-100	HHCS 1/4-20 X 0.63 GR8 BO
21	4	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
22	3	818-227-082	RHPMS 6-32 X 0.50 ZN SEMS
23	2	818-240-082	PHPMS 10-32 X 0.50 ZN SEMS
24	25	839-549-002	HLN 1/4-20 FLX CAD L/F
25	3	843-127-002	KN 6-32 ZN
26	2	843-140-002	KN 10-32 ZN

ITEM	QTY	PART #	DESCRIPTION
27	2	863-030-080	PHPMS M3-.5 X 8 ZN
28	4	948-753-102	FW 1/4 SAE NS

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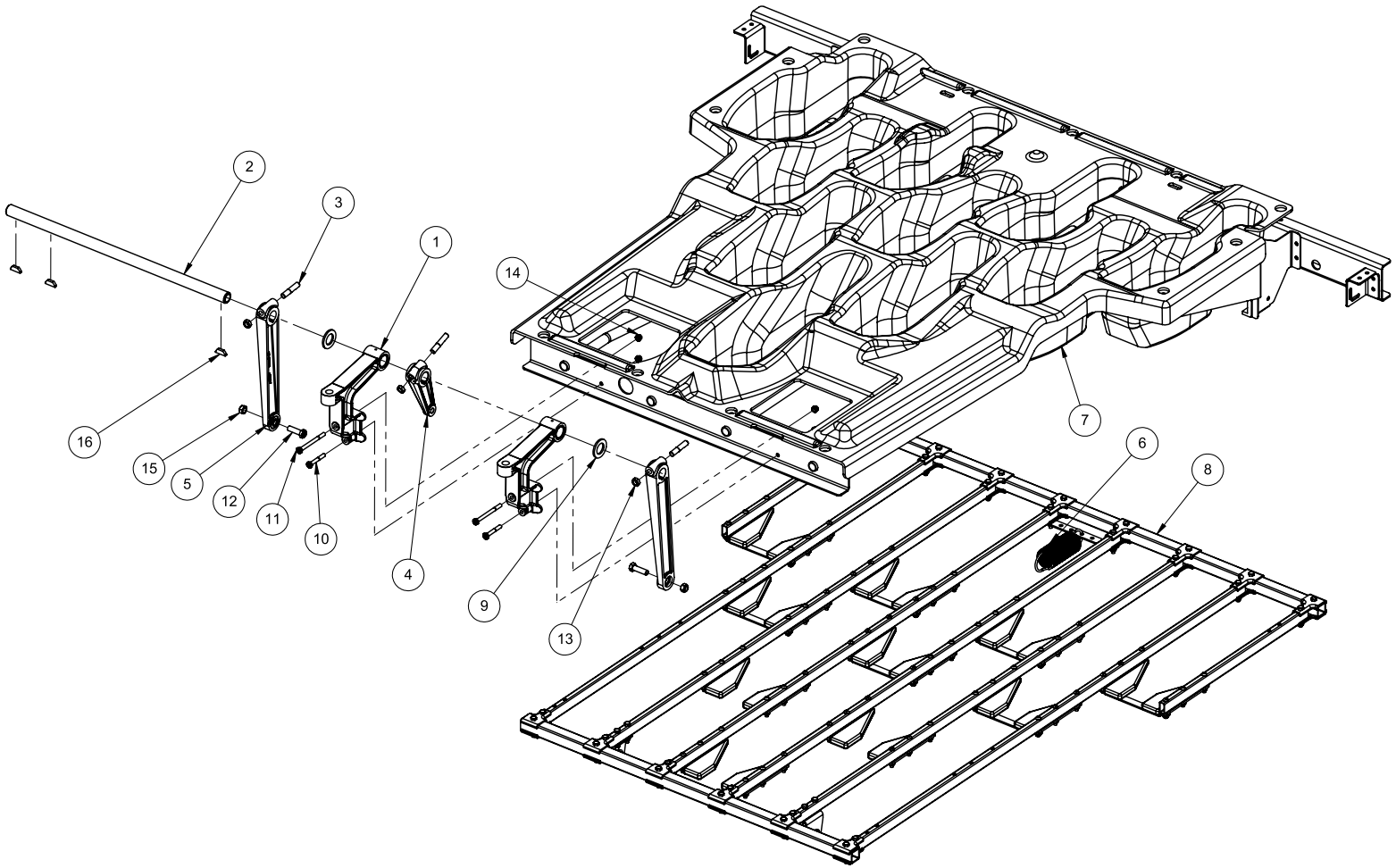

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ITEM	QTY	PART #	DESCRIPTION
1	2	070-006-358	BRACKET ASM, BIN ASM
2	1	070-006-402	SHAFT, BIN ASM
3	3	070-006-403	STUD CLAMP, BIN ASM
4	1	070-006-408	LEVER, FRONT END ASM
5	2	070-006-429	SHUTTLE OP ARM ASM
6	1	070-006-447	BIN / SHUTTLE SPRING
7	1	088-000-259	DBII ASM BSO
8	1	088-500-162	90XLi SHUTTLE ASM - METRIC
9	2	701-329-050	BSH SV 0.89 X 1.50 X 0.13 SL
10	2	809-849-285	HHCS 1/4-20 X 1.75 GR8 BO
11	2	809-849-485	HHCS 1/4-20 X 3.00 GR8 PB
12	2	809-865-205	HHCS 3/8-16 X 1.25 GR8 PB
13	3	835-565-002	HFJN 3/8-16 ZN
14	4	839-549-002	HLN 1/4-20 FLX CAD L/F
15	2	844-065-002	HLN 3/8-16 CAD STV
16	3	907-000-600	KEY HP 0.19 X 0.88

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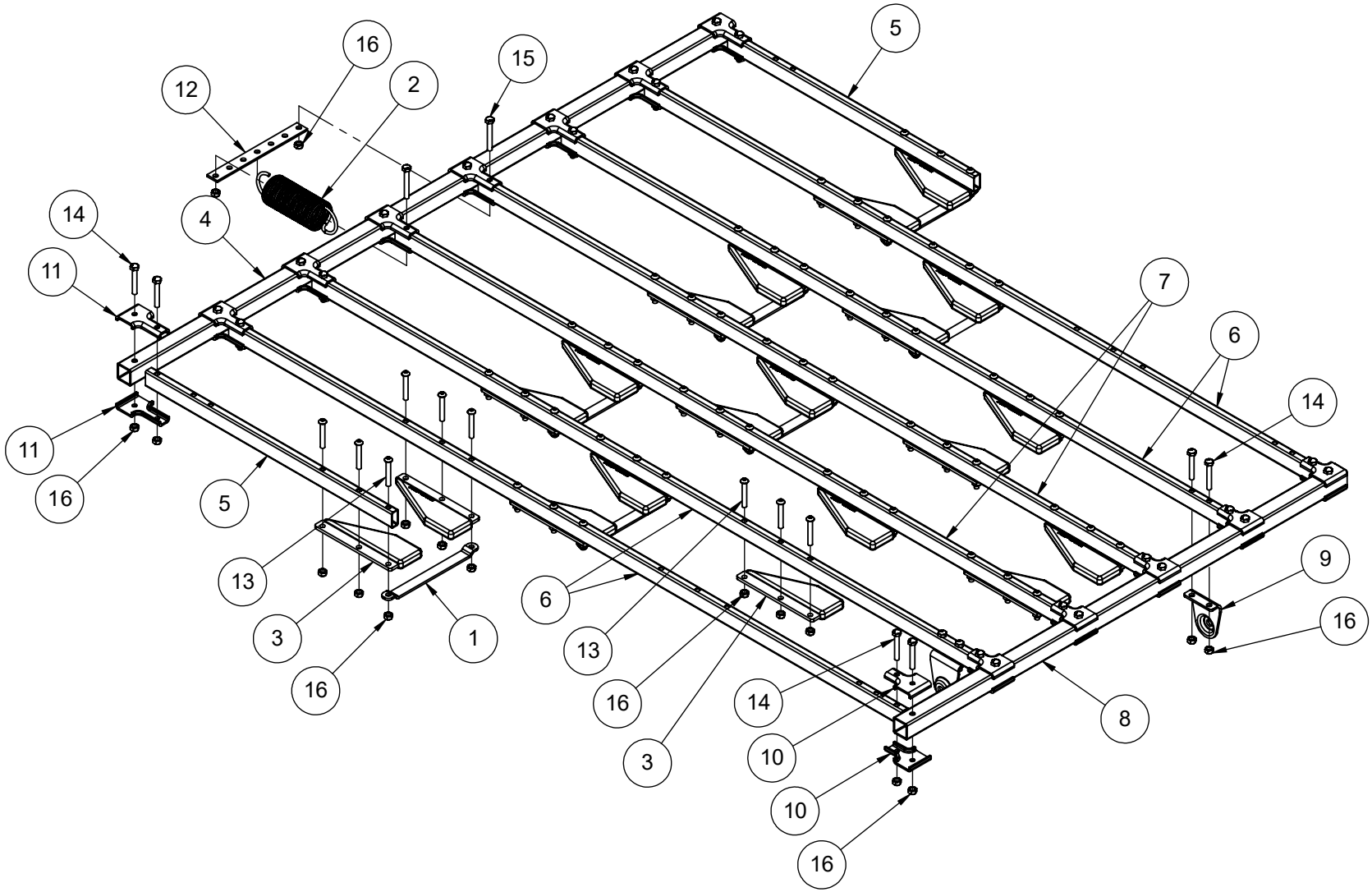

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ITEM	QTY	PART #	DESCRIPTION
1	7	070-006-268	STRAP, SHUTTLE ASM
2	1	070-006-447	BIN / SHUTTLE SPRING
3	20	088-001-211	PIN HOLDER, XLi SHUTTLE ASM
4	1	088-500-153	CROSS TUBE LONG; SHUTTLE ASM
5	2	088-500-154	TUBE SHUTTLE, SHORT
6	4	088-500-155	TUBE LONG; SHUTTLE ASM
7	2	088-500-157	TUBE SHUTTLE, CTR; SHUTTLE ASM
8	1	088-500-158	CROSS TUBE SHORT; SHUTTLE ASM
9	2	088-500-159	SHUTTLE ARM BRACKET
10	12	088-500-161	CLAMP, END; SHUTTLE ASM
11	16	088-500-163	DBII REAR SHUTTLE CLAMP
12	1	088-500-166	STRAP-SPRING-BIN
13	60	709-013-062	BHSCS M6-1 X 40 SS
14	30	861-013-062	HHCS M6-1 X 40 SS
15	2	861-206-042	HHCS M6-1 X 45 SS
16	92	872-062-012	HLN M6-1 SS NE

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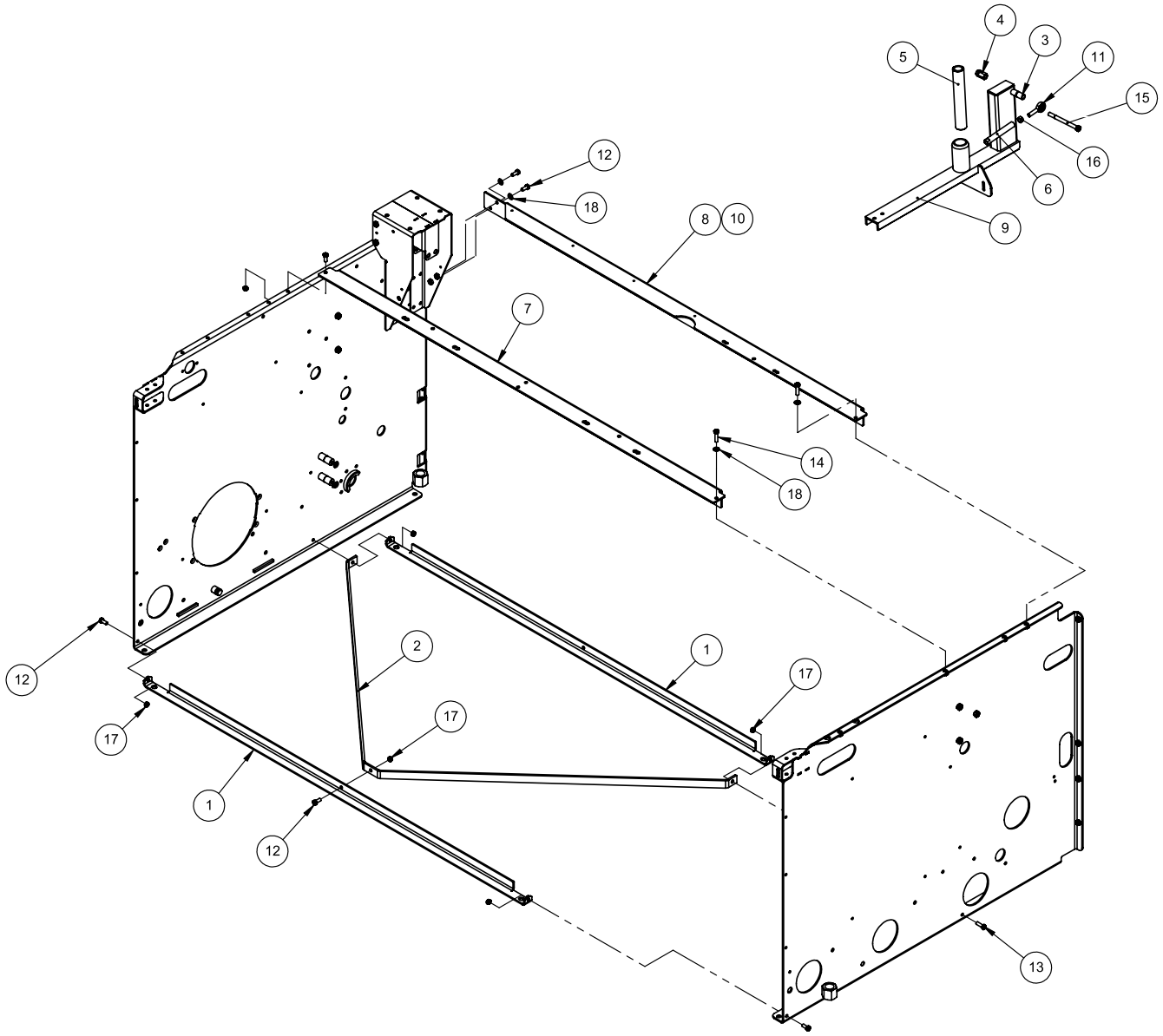

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ITEM	QTY	PART #	DESCRIPTION
1	2	070-001-184	STRAP
2	1	070-001-185	BRACE
3	1	070-006-043	SPACER, DISTRIBUTOR
4	1	070-006-044	SPRING POST NUT, 3/8-16
5	1	070-006-045	POST, DISTRIBUTOR SUPPORT
6	1	070-006-047	SAFETY LINK TUBING, DIST
7	1	070-007-359	DISTRIBUTOR SPRT ANGL
8	1	088-501-780	DISTRIBUTOR SUPPORT ASM, EVEN
9	1	088-001-522	TSE DISTRIBUTOR SPPRT WLDMT
10		088-501-781	ASM, DIST SUPPORT, ODD
11	1	090-005-256	ROD END DIST. SUPPORT
12	6	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
13	2	809-857-165	HHCS 5/16-18 X 1.00 GR8 PB
14	2	809-857-205	HHCS 5/16-18 X 1.25 GR8 PB
15	1	809-865-725	HHCS 3/8-16 X 4.50 GR8 BO
16	1	831-566-002	HFN 3/8-24 ZN
17	6	844-057-002	HLN 5/16-18 CAD STV
18	4	948-761-112	FW 5/16 SAE NS

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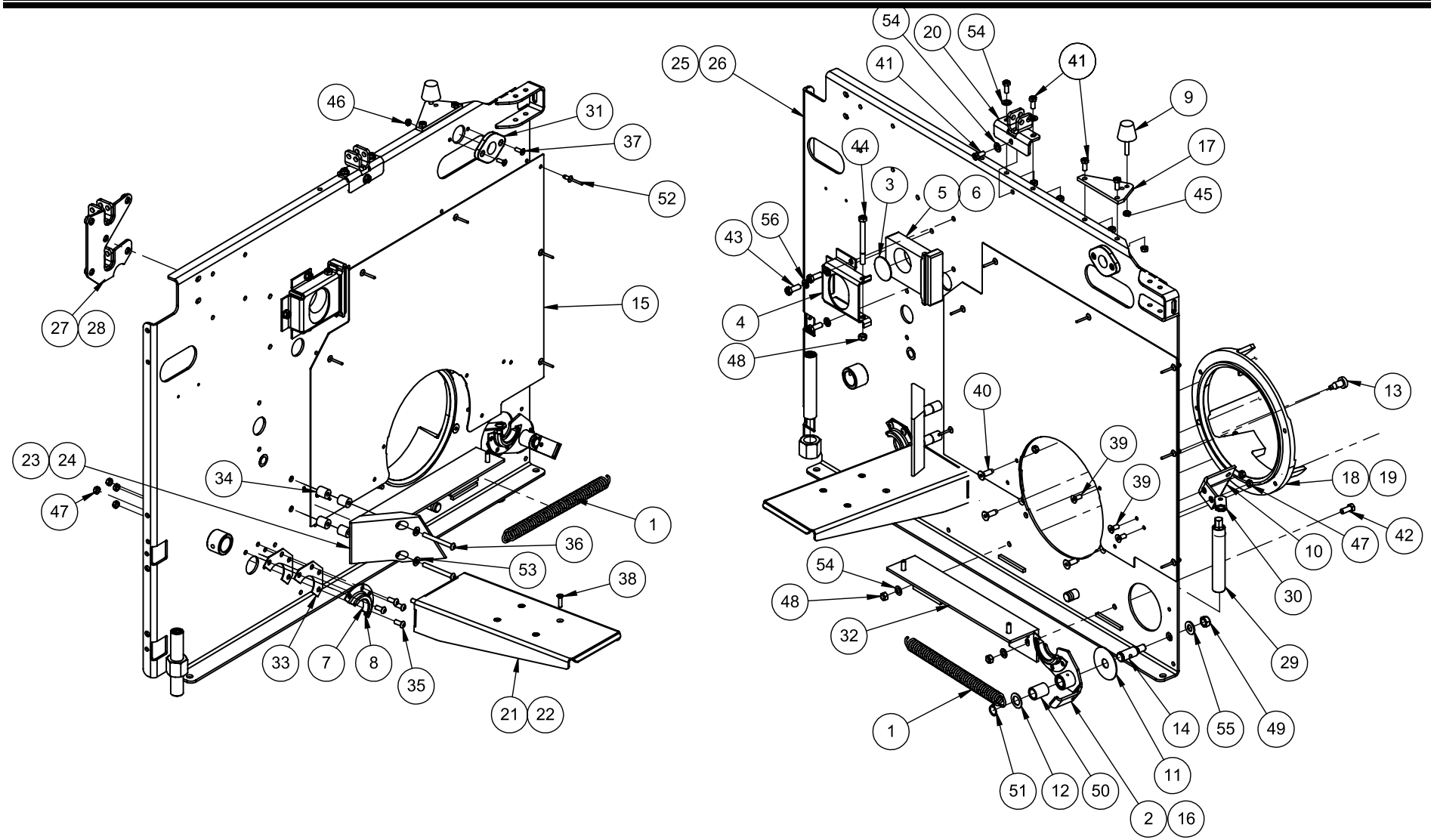

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ITEM	QTY	PART #	DESCRIPTION
1	1	000-021-204	SPRING, CARPET
2		000-022-249	BEARING BRKT ASM EVEN 7P
3	1	000-022-300	SHIELD
4	1	000-022-788	CUSHION BOX SPRT
5	1	000-022-796	BLOCK SUPPORT 10P
6		000-022-797	BLOCK SUPPORT 7P
7	2	000-022-924	BEARING SUPPORT
8	1	000-022-926	RETAINER SPRT
9	1	000-024-641	STOP BUMPER
10	1	000-024-668	TRACK SPRT BRKT WLDMT
11	1	000-027-641	BSH TH 0.76 X 2.75 X 0.06 PN
12	1	000-027-642	FW 0.76 X 1.25 X 0.05 NS
13	1	000-028-362	BUMPER, URETHANE
14	1	000-029-015	PIVOT STUD
15	1	000-029-640	KICKBACK PANEL
16	1	000-029-672	BEARING BRKT ASM ODD 10P
17	1	070-004-642	BALL LIFT STOP BRACKET
18		070-011-641-01	URETHANE DOOR RING EVEN LANE
19	1	070-011-642-01	URETHANE DOOR RING ODD LANE
20	1	088-001-034	SINGLE SADDLE BRKT WLDMT
21	1	088-001-571	ANTI-IDLING CHAN WLDMT ODD
22		088-001-572	ANTI-IDLING CHAN WLDMT EVEN
23		088-001-640	EDGE, PLOW, CORNER, EVEN
24	1	088-001-641	EDGE, PLOW, CORNER, ODD
25		088-001-858	KICKBACK ASM EVEN, 07P
26		088-001-859	KICKBACK ASM ODD, 10P
27	1	088-001-861	BALL LIFT BRKT WLDMT ODD, 10P
28		088-001-862	BALL LIFT BRKT WLDMT EVEN, 7P
29	1	088-002-275	JACK SCREW
30	1	088-002-276	LOCKING TAB
31	2	088-500-190	CURTAIN ROD BUSHING CS
32	2	090-004-131	PIT SPRT BRKT WLDMT
33	2	090-004-136	SPACER
34	4	722-505-002	SFR 0.32 X 0.75 X 0.88 AL
35	4	808-557-120	BHSCS 5/16-18 X 0.75 BO
36	2	808-557-481	BHSCS 5/16-18 X 3.00 BO
37	2	808-849-120	FHSCS 1/4-20 X 0.75 BO
38		808-849-160	FHSCS 1/4-20 X 1.00 BO
39	3	808-857-120	FHSCS 5/16-18 X 0.75 BO
40	3	808-865-160	FHSCS 3/8-16 X 1.00 BO
41	5	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
42	2	809-865-145	HHCS 3/8-16 X 0.88 GR8 PB
43	3	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
44	1	809-865-645	HHCS 3/8-16 X 4.00 GR8 BO
45	1	835-558-002	HFJN 5/16-24 ZN
46	6	844-049-002	HLN 1/4-20 CAD STV
47	13	844-057-002	HLN 5/16-18 CAD STV
48	3	844-065-002	HLN 3/8-16 CAD STV
49	1	844-074-002	HLN 1/2-20 CAD STV
50	1	900-112-203	BSH SV 0.75 X 1.00 X 1.25 FE
51	1	919-005-800	RNG SE 0.750 X 0.042 NS
52	7	938-101-015	1/4 RIVET PLASTIC BLACK
53	2	948-761-112	FW 5/16 SAE NS
54	5	948-767-132	FW 0.41 X 0.73 X 0.06 ZN
55	1	948-975-172	FW 0.53 X 1.06 X .10 NS
56	3	951-164-002	SWM 3/8 ANSI NS

WORLDWIDE HEADQUARTERS
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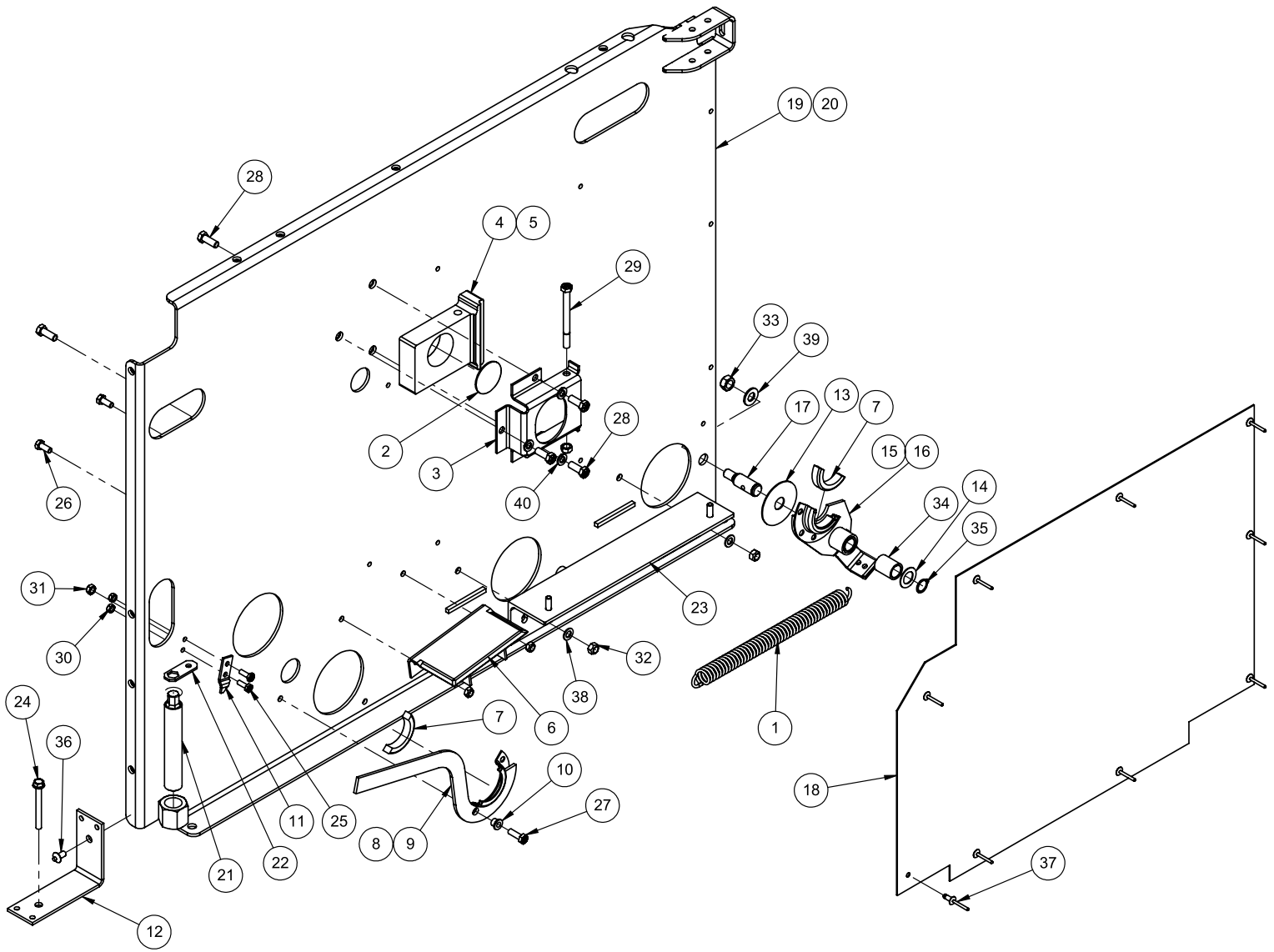

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ITEM	QTY	PART #	DESCRIPTION
1	1	000-021-204	SPRING, CARPET
2	1	000-022-300	SHIELD
3	1	000-022-788	CUSHION BOX SPRT
4	1	000-022-796	BLOCK SUPPORT 10P
5		000-022-797	BLOCK SUPPORT 7P
6	1	000-022-878	ANGLE WLDMT ANGLE K/B PL
7	2	000-022-924	BEARING SUPPORT
8		000-023-464	CARPET BRKT SPRT WLDMT ODD
9	1	000-023-465	CARPET BRKT SPRT WLDMT EVN
10	1	000-023-467	BSH FS 0.32 X 0.44 X 0.41 STL
11	1	000-023-468	BE BRACKET, LH
12	1	000-026-464	BRACKET KICKBACK PIT
13	1	000-027-641	BSH TH 0.76 X 2.75 X 0.06 PN
14	1	000-027-642	FW 0.76 X 1.25 X 0.05 NS
15		000-027-645	BEARING BRKT ASM ODD 7P
16	1	000-027-646	BEARING BRKT ASM EVEN 10P
17	1	000-029-015	PIVOT STUD
18	1	070-002-027	KICKBACK PANEL
19		088-001-591	KICKBACK WLDMT ODD, 7P
20	1	088-001-594	KICKBACK WLDMT EVEN, 10P
21	1	088-002-275	JACK SCREW
22	1	088-002-276	LOCKING TAB
23	1	090-004-131	PIT SPRT BRKT WLDMT
24	1	709-013-059	ANCR BL M8 X 75 ZN
25	2	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
26	2	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
27	1	809-857-165	HHCS 5/16-18 X 1.00 GR8 PB
28	5	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
29	1	809-865-645	HHCS 3/8-16 X 4.00 GR8 BO
30	2	844-049-002	HLN 1/4-20 CAD STV
31	3	844-057-002	HLN 5/16-18 CAD STV
32	3	844-065-002	HLN 3/8-16 CAD STV
33	1	844-074-002	HLN 1/2-20 CAD STV
34	1	900-112-203	BSH SV 0.75 X 1.00 X 1.25 FE
35	1	919-005-800	RNG SE 0.750 X 0.042 NS
36	1	937-738-003	RVT DRD 0.31 X 0.56 ST
37	9	938-101-015	1/4 RIVET PLASTIC BLACK
38	2	948-767-132	FW 0.41 X 0.73 X 0.06 ZN
39	1	948-975-172	FW 0.53 X 1.06 X .10 NS
40	3	951-164-002	SWM 3/8 ANSI NS

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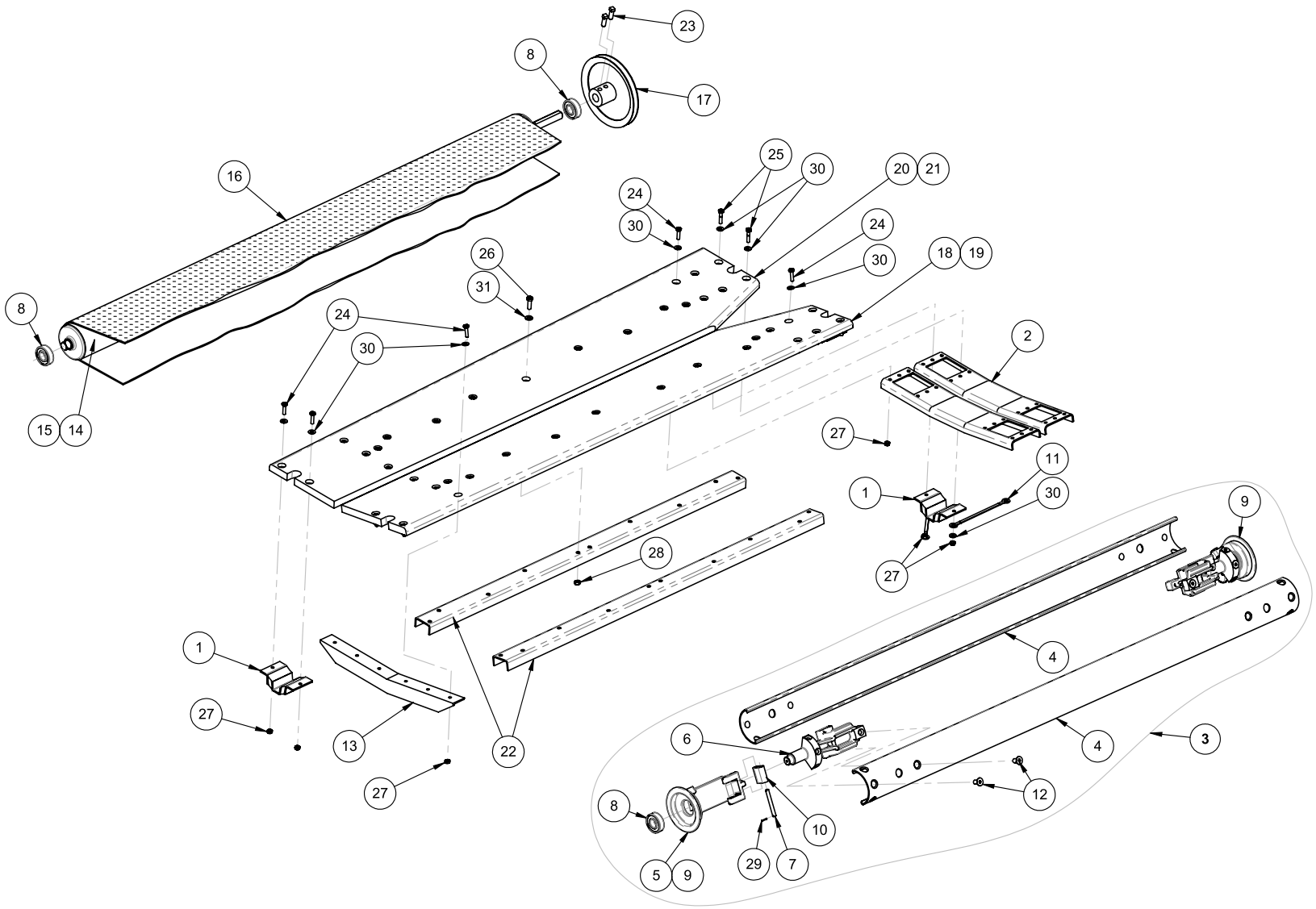

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ITEM	QTY	PART #	DESCRIPTION
1	4	000-021-224	VIBRATION DAMPENER
2	2	000-021-914	CHANNEL BOUNCE BD ASM
3	1	000-024-576	FRONT ROLLER ASM BE (INCLUDES 4, 9,
4	2	000-024-578	FRNT ROLLER BODY
5	2	000-024-579	ROLLER HINGE
6	2	000-024-580	SHAFT HINGE FRNT ROLLER ASM
7	4	000-024-582	PIN SP 0.31 X 2.62 NS
8	4	000-024-590	BRG B 2E 20X47X14 _ 6204-2RS
9	2	000-024-592	HINGE ASM FRONT ROLLER (INCLUDES 5,
10	2	000-024-760	LINK FRNT ROLLER ASM
11	1	000-025-622	STRAP BONDING
12	16	000-025-662	FHSCS 3/8-24 X 0.75 NS PA
13	1	000-029-626	ANGL SPRT
14	1	070-002-033	REAR ROLLER
15	1	070-002-034	REAR ROLLER ASM (INCLUDES 8 & 14)
16	1	000-026-753-	CARPET BELT
17	1	090-004-203	82-90 CARPET DRIVE SHEAVE
18	1	090-005-270	PHENOLIC BOUNCE BD FRONT ODD
19	1	090-005-271	PHENOLIC BOUNCE BD FRONT EVEN
20	1	090-005-272	PHENOLIC BOUNCE BD REAR ODD
21	1	090-005-273	PHENOLIC BOUNCE BD REAR EVEN
22	2	090-005-274	SUPPORT CHANNEL
23	2	806-265-160	QHSS 3/8-16 X 1.00 CUP BO
24	18	809-849-165	HHCS 1/4-20 X 1.00 GR8 BO
25	4	809-849-205	HHCS 1/4-20 X 1.25 GR8 PB
26	18	809-857-165	HHCS 5/16-18 X 1.00 GR8 PB
27	22	844-049-002	HLN 1/4-20 CAD STV
28	18	844-057-002	HLN 5/16-18 CAD STV
29	8	913-411-100	PIN RL 0.08 X 0.63 NS
30	23	948-753-102	FW 1/4 SAE NS
31	18	948-761-112	FW 5/16 SAE NS
26	18	809-857-165	HHCS 5/16-18 X 1.00 GR8 PB
27	22	844-049-002	HLN 1/4-20 CAD STV
28	18	844-057-002	HLN 5/16-18 CAD STV
29	8	913-411-100	PIN RL 0.08 X 0.63 NS
30	23	948-753-102	FW 1/4 SAE NS
31	18	948-761-112	FW 5/16 SAE NS

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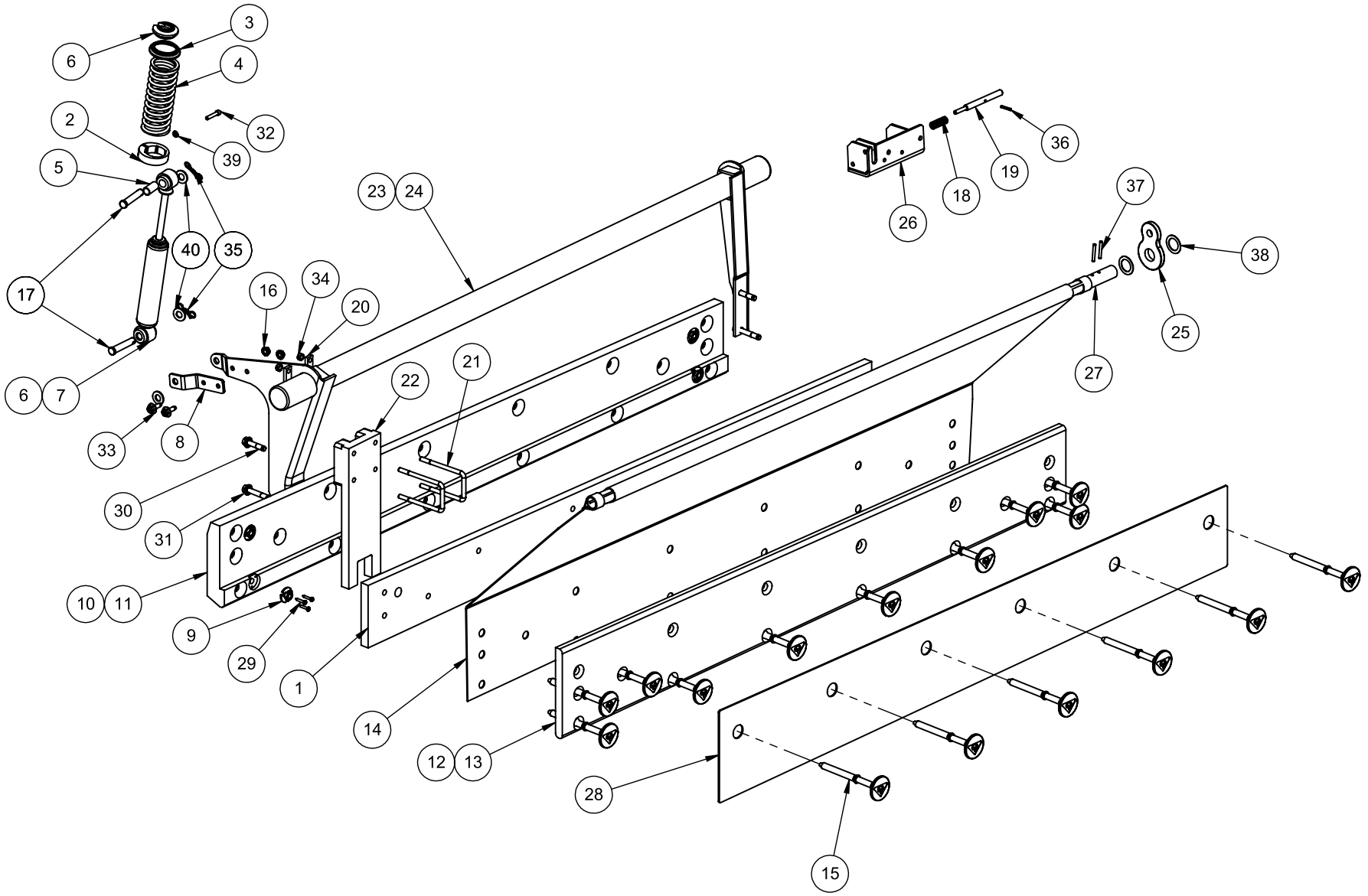

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1	1	000-022-770	SPONGE PAD, CUSHION ASM
2		000-022-286	CUSHION STRUT COLLAR
3		000-022-287	SPRING SEATING WASHER
4		000-022-288	SPRING
5		000-022-822	SLEEVE
6		000-022-823	SHOCK ASB W/ UPPER COLLAR
7	1	000-022-824	SHOCK ASB ASM, CUSHION
8	1	000-024-534	EAR HANGER, CUSHION ASM
9	4	000-024-750	CUSHION MOUNT WELDNUT
10	1	000-024-795	PLANK EVEN, CUSHION ASM EVEN
11		000-024-796	PLANK ODD (not shown)
12		000-024-807	CUSHION RUBBER ODD (not shown)
13	1	000-024-808	CUSHION RUBBER, EVEN
14	1	000-026-450	PIN CURTAIN ASM
15	16	000-028-529	RIVET, CUSHION ASM
16	2	01-519	HFLN 5/16-18 ZN SER
17	2	051-200-349	PIN CL 0.50 X 2.17
18		070-001-389	CURTAIN LATCH SPRING
19		070-001-396	CURTAIN LATCH PIN
20	2	070-001-421	STRAP, CUSHION ASM
21	2	070-001-422	UB 5/16-18 X 4.25 BO SQ
22	1	070-001-432	PAD, CUSHION ASM
23		070-002-050	TUBE WLDMT, ODD (not shown)
24	1	070-002-252	CUSHION TUBE WLDMT, EVEN

ITEM	QTY	PART #	DESCRIPTION
25	1	070-005-610	LINK, CUSHION ASM
26		070-007-360	SUPPORT BRACKET WELDMENT
27	1	070-011-288	CURTAIN ROD, CUSHION ASM
28	1	090-005-279	CUSHION COVER 6 HOLE
29	12	7023-410800-100	PHPPS 8 X 1.00 BO
30	2	801-865-287	FBCS 3/8-16 X 1.75 GR8 BO PAS
31	2	801-865-367	FBCS 3/8-16 X 2.25 GR8 BO PAS
32		810-250-200	1/4-28 x 1 1/4 SCREW CSH
33	2	818-757-161	HWMS 5/16-18 X 1.00 GR8 BP DP
34	4	844-057-002	HLN 5/16-18 CAD STV
35	2	911-073-307	PIN BC 0.09 X 1.88 ZN
36		913-431-160	.156 X 1 SPRING PIN
37	2	913-437-240	PIN RL 0.19 X 1.50 NS
38	2	945-091-242	FW 1.02 X 1.50 X 0.05 ZN
39		951-148-002	SWM 1/4 ANSI ZN
40		948-975-172	7/32 X 1 1/16 WASHER

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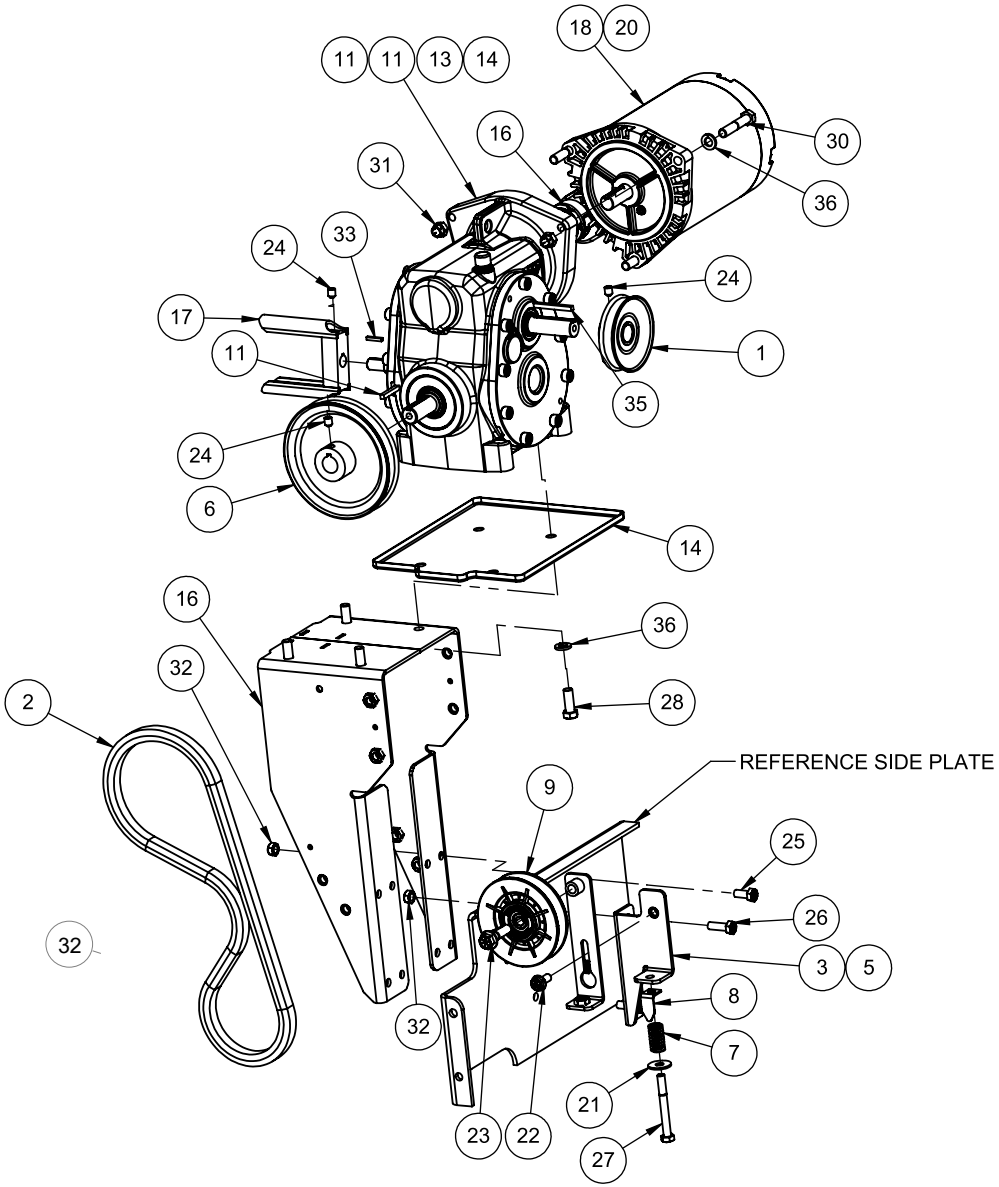

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ITEM	QTY	PART #	DESCRIPTION
1	1	000-022-172	DRIVE SHEAVE
2	2	088-001-528	HEX V-BELT 35"
3		088-001-534	IDLER MOUNT, ODD
4	1	088-001-535	TSE IDLER BAR WLDMT
5	1	088-001-539	TSE IDLER MOUNT EVEN WLDMT
6	1	088-001-822	SHEAVE, B BELT, 5.00 IN PD
7	1	088-001-823	COMPRESSION SPRING
8	1	088-001-824	TSE IDLER SPRING INDICATOR
9	1	088-001-825	IDLER PULLEY, B-BELT, 4 IN
10		088-004-601	BE GB 60Hz ODD
11	1	088-004-602	BE GB 60Hz EVEN
12		088-004-606	BE GB 50Hz ODD
13		088-004-607	BR GB 50Hz EVEN
14	1	088-004-650	DRIP PAN
15		088-004-716	COUPLING REPLACEMENT KIT
16		088-501-764	ASM, BRKT, MOTOR, BE
17	1	090-001-130	DISTRIBUTOR DRIVE HOUSING
18	1	090-003-766	BE MOTOR, 60HZ
19		090-004-520	PIT CONVEYOR DRIVE BELT (not shown)
20	1	090-007-310	BE MOTOR, 50HZ
21	1	7050-034100-006	FW 0.36 X 0.98 X 0.08 ZN
22	1	801-757-121	FBCS 5/16-18 X 0.75 GR5 BP PA
23	1	801-765-241	FBCS 3/8-16 X 1.50 GR8 BO
24	2	807-358-060	SSS 5/16-24 X 0.38 KNL BO
25	2	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
26	2	809-857-165	HHCS 5/16-18 X 1.00 GR8 PB
27	1	809-857-445	HHCS 5/16-18 X 2.75 GR8 BO
28	4	809-865-165	HHCS 3/8-16 X 1.00 GR8 PB
29	1	809-865-245	HHCS 3/8-16 X 1.50 GR8 BO
30	2	809-865-325	HHCS 3/8-16 X 2.00 GR8 PB
31	2	839-665-002	HLN 3/8-16 FLX CAD L/F
32	4	844-057-002	HLN 5/16-18 CAD STV
33		907-200-500	1/8 x 3/4 KEY SQ
34	1	907-201-000	KEY SQ 0.19 X 1.25 Q
35		907-202-600	3/16 x 1-7/8 KEY SQ GEAR SHAFT
36	7	951-164-002	SWM 3/8 ANSI NS

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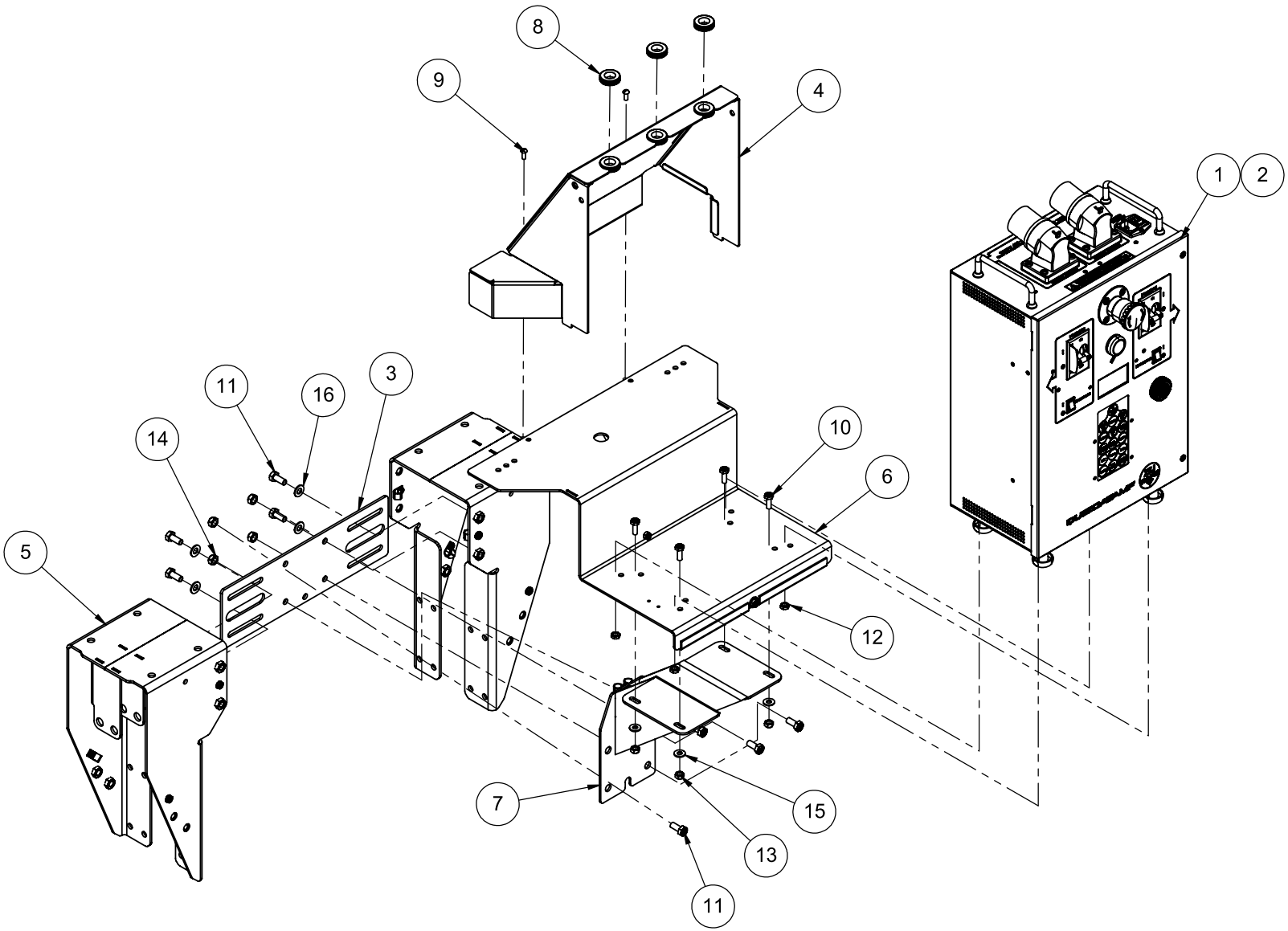

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* FOR SMARTGUARD CHASSIS MOUNTING COMPONENTS, REFER TO THE *SMARTGUARD SAFETY SYSTEM MANUAL, 400-088-092-xx*.

ITEM	QTY	PART #	DESCRIPTION
1	1	088-401-000	SYSTEM CONTROLLER, EFF
2		088-401-001	SYSTEM CONTROLLER, EFF
3	1	088-001-804	BE EDGE, TIE PLATE
4	1	088-501-896	CTRL CVR ASM, WIDE DUCT
5	2	088-501-764	ASM, BRKT, MOTOR, BE
6	1	088-501-772	ASM, BRKT, CONTROLLER
7	1	088-501-779	ASM, MOUNT, CONTROLLER
8	3	711-520-012	GPI 0.63 X 0.88 X 0.06 RB 1
9	2	812-840-082	RHFMS 10-32 X 0.50 ZN
10	4	809-849-125	HHCS 1/4-20 X 0.75 GR8 BO
11	8	809-857-125	HHCS 5/16-18 X 0.75 GR8 PB
12	4	835-549-002	HFJN 1/4-20 ZN
13	4	844-049-002	HLN 1/4-20 CAD STV
14	4	844-057-002	HLN 5/16-18 CAD STV
15	4	948-753-102	FW 1/4 SAE NS
16	4	948-761-112	FW 5/16 SAE NS

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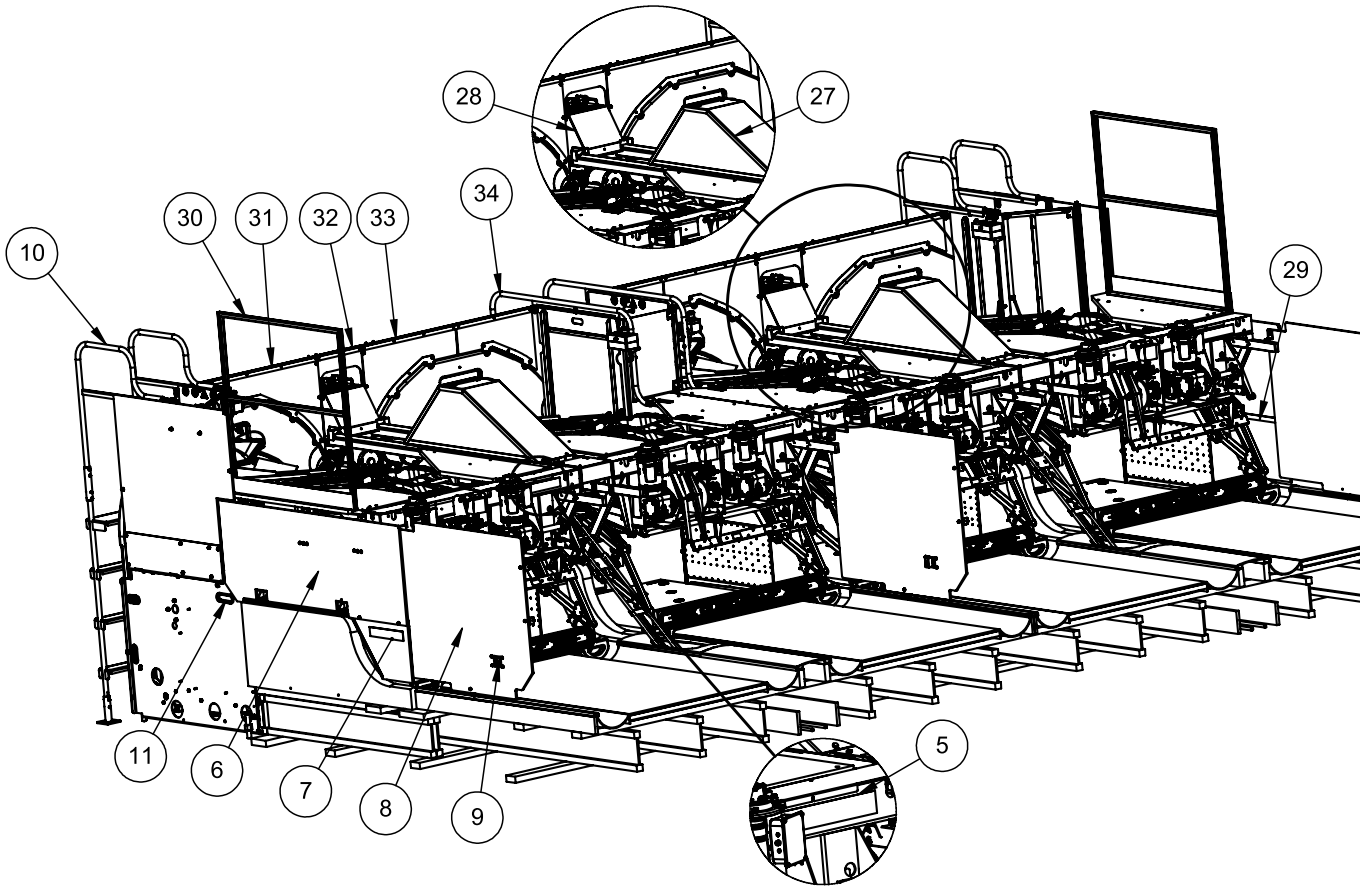
5 - 

7 - 

14 - 

26 - 



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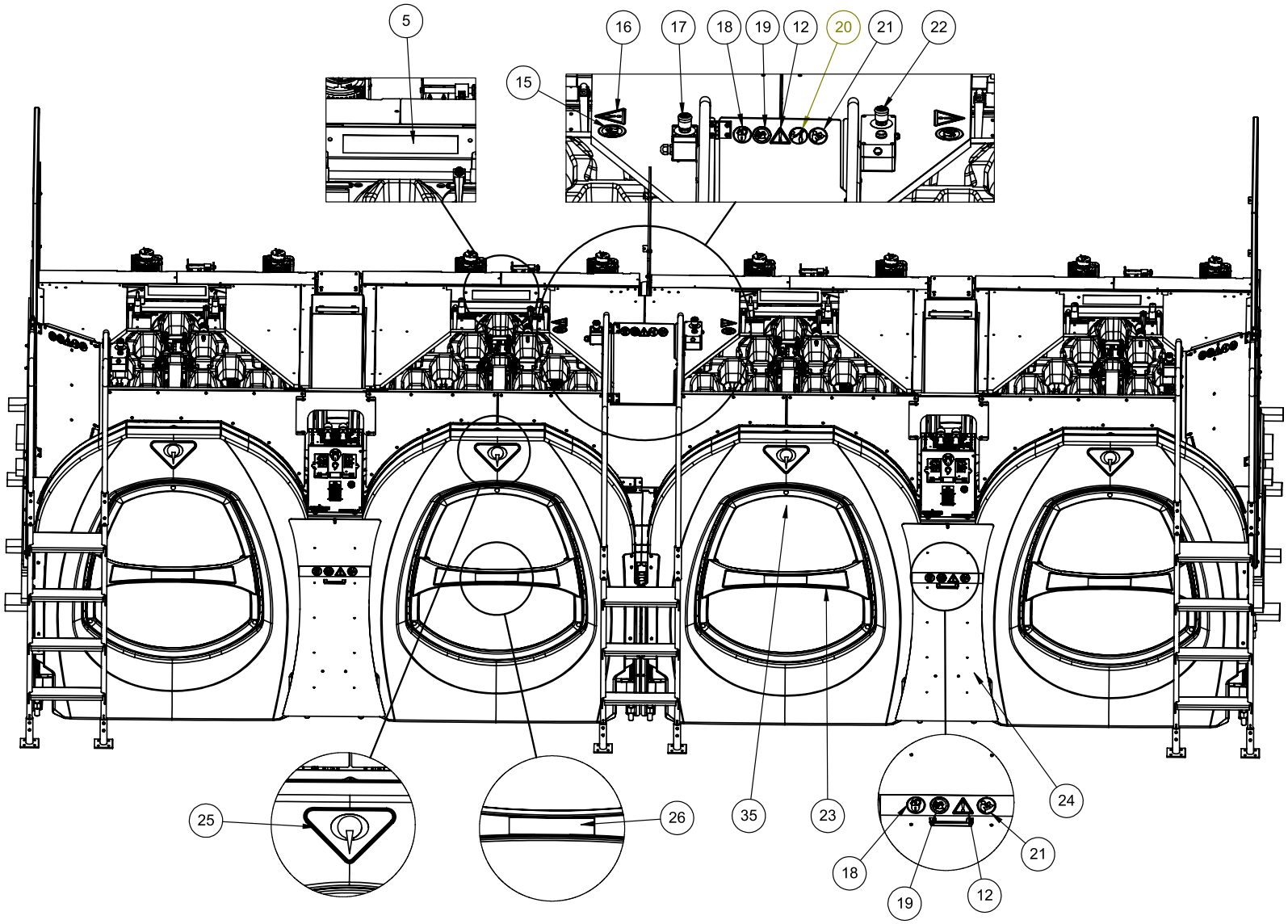

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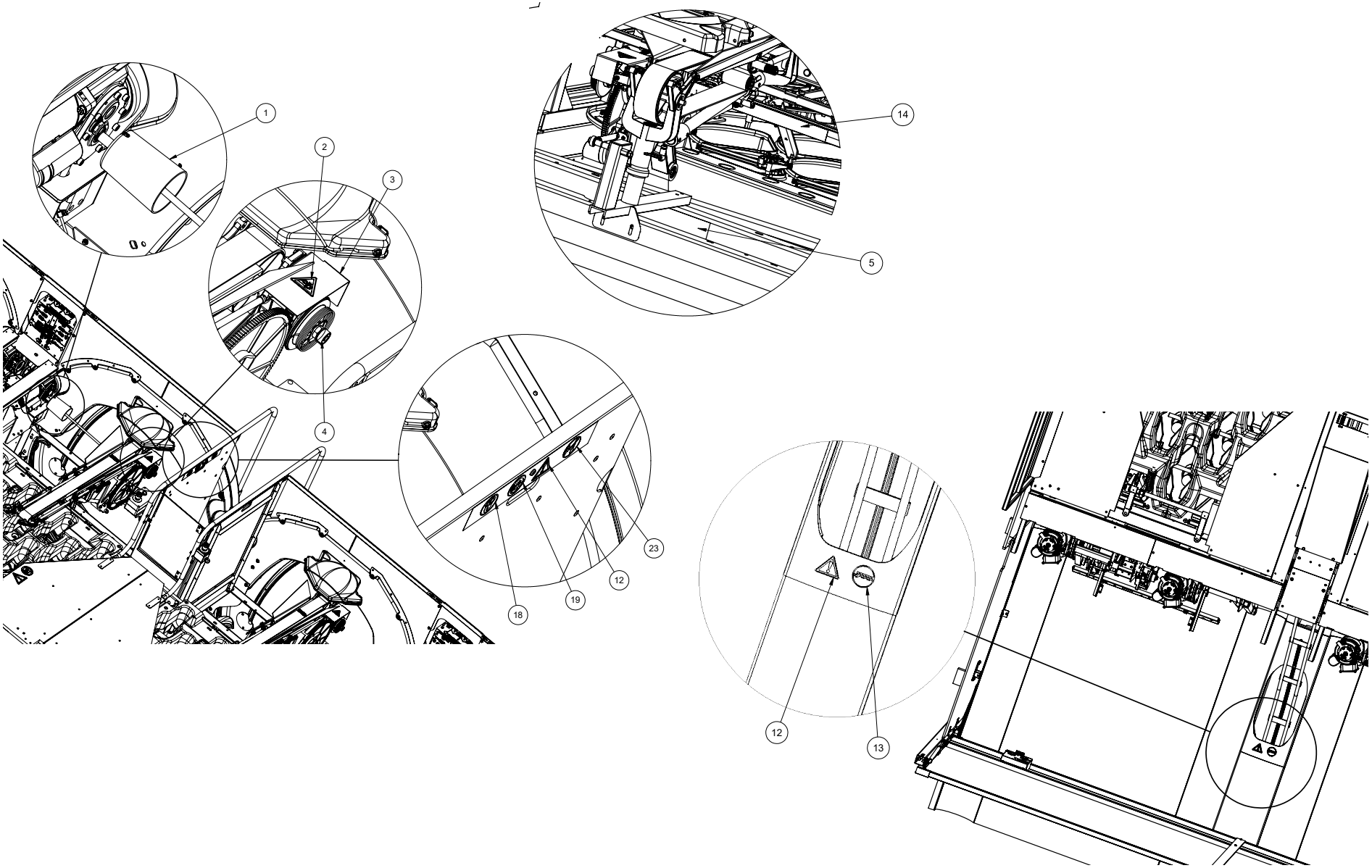

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1	088-001-879	DIST DRIVE HOUSING GUARD
2	051-070-084	DIST PINION GUARD LABEL
3	088-501-738	DIST PINION GUARD
4	088-000-156	DIST PIN ASSEMBLY
5	090-004-028	WARNING LABEL- CROSSBEAM, DIST SUPPORT
6	090-006-243	ODD END GUARD
7	088-001-154	SIDE GUARD LABEL
8	088-501-669	PAIR ISOLATION PANEL
9	088-200-695	IR SENSOR SET
10	088-501-708	END LADDER ASSEMBLY
10	088-501-751	END LADDER ASSEMBLY (CONT)
10	088-501-775	END LADDER ASSEMBLY (CONT)
11	088-002-274	HAND HOLE GUARD
12	051-070-083	2” WARNING LABEL
13	051-070-134	2” LANE BARRIER LABEL
14	090-004-302	X FRAME WARNING LABEL
15	051-070-138	3” WARNING LABEL
16	051-070-081	3” NO ACCESS LABEL
17	088-201-183	ODD LANE E-STOP BOX

ITEM	PART #	DESCRIPTION
18	051-070-140	2” LOTO LABEL
19	051-070-043	2” NO ACCESS
20	051-070-082	2” PIN HOOK
21	051-070-139	2” READ THE MANUAL
22	088-201-182	EVEN LANE E-STOP/RESET
23	088-001-558	CENTER GUARD
24	088-501-739	LBS GUARD
25	252-001-160	QUBICAAMF LABEL
26	088-501-795	CENTER GUARD LABEL
27	070-011-401	PBL GUARD
28	088-200-481	SYSTEM CONTROLLER GUARD
29	090-006-230	EVEN END GUARD
30	088-501-815	WALKBOARD HANDRAIL
31	088-501-745	REAR END GUARD ODD
32	088-501-721	REAR CONTROLLER GUARD
33	088-501-744	REAR END GUARD EVEN
34	088-500-045	COMMON LADDER ASSEMBLY
34	088-501-771	COMMON LADDER ASSEMBLY (CONT)
35	770-060-250	CENTER GUARD MAG INTERLOCK

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PARTS INDEX

000-021-204 ..... 5-55, 5-57
000-021-224 5-59
000-021-423 5-31
000-021-528 ..... 5-5, 5-7
000-021-786 ..... 5-5, 5-7
000-021-787 ..... 5-5, 5-7
000-021-878 5-19
000-021-879 5-19
000-021-881 5-19
000-021-914 5-59
000-022-172 5-63
000-022-249 5-55
000-022-286 5-61
000-022-287 5-61
000-022-288 5-61
000-022-300 ..... 5-55, 5-57
000-022-770 5-61
000-022-782 5-27
000-022-788 ..... 5-55, 5-57
000-022-796 ..... 5-55, 5-57
000-022-797 ..... 5-55, 5-57
000-022-822 5-61
000-022-823 5-61
000-022-824 5-61
000-022-878 5-57
000-022-924 ..... 5-55, 5-57
000-022-926 5-55
000-023-104 5-23
000-023-114 ..... 5-23, 5-43
000-023-139 5-15
000-023-464 5-57
000-023-465 5-57
000-023-467 5-57
000-023-468 5-57
000-024-534 5-61
000-024-576 5-59
000-024-578 5-59
000-024-579 5-59
000-024-580 5-59
000-024-582 5-59
000-024-590 5-59
000-024-592 5-59
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000-024-807 5-61
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000-025-549 5-45
000-025-622 5-59
000-025-662 5-59
000-026-032 5-45
000-026-042 5-27
000-026-450 5-61
000-026-464 5-57
000-026-753-BLK 5-59
000-027-641 ..... 5-55, 5-57
000-027-642 ..... 5-55, 5-57
000-027-645 5-57
000-027-646 5-57
000-028-362 5-55
000-028-529 5-61
000-029-015 ..... 5-55, 5-57
000-029-626 5-59
000-029-640 5-55
000-029-672 5-55
01-519 5-61
051-070-043 5-69
051-070-081 5-69
051-070-082 5-69
051-070-083 5-69
051-070-084 5-69
051-070-134 5-69
051-070-138 5-69
051-070-139 5-69
051-070-140 5-69
051-200-349 5-61
070-001-184 5-53
070-001-185 5-53
070-001-389 5-61
070-001-396 5-61
070-001-421 5-61
070-001-422 5-61
070-001-432 5-61
070-001-565 5-21
070-001-585 5-21
070-001-587 5-21
070-001-591 5-27
070-001-596 ..... 5-5, 5-7
070-001-605 5-21
070-001-698 ..... 5-5, 5-7, 5-11
070-001-699 5-15
070-001-707 5-15
070-001-777 5-17
070-001-807 5-31
070-001-817 ..... 5-5, 5-7
070-001-819 ..... 5-5, 5-7
070-001-849 5-19
070-001-852 5-27
070-001-853 5-27

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070-001-854 5-27
070-001-857 5-19
070-001-861 5-19
070-001-889 5-19
070-001-893 5-19
070-001-894 5-19
070-001-907 5-11
070-001-908 5-11
070-001-910 5-15
070-001-917 5-19
070-001-918 5-19
070-001-919 5-21
070-001-931 5-19
070-001-932 5-19
070-001-996 5-21
070-002-027 5-57
070-002-033 5-59
070-002-034 5-59
070-002-050 5-61
070-002-252 5-61
070-002-579 5-31
070-002-589 5-31
070-002-590 5-31
070-002-599 5-31
070-002-602 5-45
070-002-603 5-45
070-002-609 5-45
070-002-611 5-45
070-002-612 5-45
070-002-616 5-45
070-002-617 5-45
070-002-620 5-45
070-002-623 5-45
070-002-630 ..... 5-33, 5-35, 5-39, 5-41
070-002-645 ..... 5-39, 5-41
070-002-651 ..... 5-39, 5-41
070-002-652 5-19
070-002-653 ..... 5-17, 5-35, 5-39, 5-41
070-002-671 5-35
070-002-678 5-35
070-002-688 5-45
070-002-689 5-45
070-002-691 5-21
070-002-695 ..... 5-39, 5-41
070-002-719 5-45
070-002-723 5-45
070-002-724 5-31
070-002-725 5-31
070-002-745 5-31
070-002-750 ..... 5-39, 5-41
070-002-776 5-19
070-002-777 5-19
070-002-778 5-19
070-002-780 5-19
070-002-781 5-31
070-002-784 5-45
070-002-787 5-45
070-002-788 5-45
070-002-808 5-45
070-002-809 5-45
070-002-815 5-35
070-002-816 5-31
070-002-824 5-19
070-003-106 5-23
070-003-117 5-23
070-003-157 5-23
070-003-221 5-23
070-003-232 5-23
070-003-233 5-23
070-003-243 5-15
070-003-245 5-23
070-004-642 5-55
070-004-654 ..... 5-5, 5-7
070-005-610 5-61
070-006-043 5-53
070-006-044 5-53
070-006-045 5-53
070-006-047 5-53
070-006-048 5-27
070-006-116 5-17
070-006-121 5-23
070-006-268 5-51
070-006-276 5-17
070-006-277 5-17
070-006-278 5-17
070-006-282 5-17
070-006-283 5-17
070-006-284 5-17
070-006-287 5-17
070-006-292 5-17
070-006-295 5-17
070-006-358 5-49
070-006-402 5-49
070-006-403 5-49
070-006-405 ..... 5-5, 5-7, 5-9
070-006-408 5-49
070-006-411 ..... 5-5, 5-7
070-006-413 ..... 5-5, 5-7
070-006-414 ..... 5-5, 5-7, 5-9
070-006-425 ..... 5-5, 5-7
070-006-426 ..... 5-5, 5-7
070-006-427 5-15
070-006-429 5-49
070-006-447 ..... 5-49, 5-51
070-006-456 5-17
070-006-459 5-21
070-006-479 5-21
070-006-481 5-21
070-006-490 ..... 5-5, 5-7
070-006-492 ..... 5-15, 5-21
070-006-493 ..... 5-15, 5-21

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070-006-724 5-17
070-006-728 ..... 5-17, 5-21
070-006-729 5-19
070-006-765 5-15
070-007-192 ..... 5-39, 5-41, 5-47
070-007-195 ..... 5-39, 5-41
070-007-276 5-23
070-007-278 5-23
070-007-283 5-23
070-007-303 5-27
070-007-310 5-19
070-007-311 5-19
070-007-359 5-53
070-007-360 5-61
070-007-509 ..... 5-5, 5-7
070-007-510 ..... 5-5, 5-7
070-007-752 5-27
070-007-755 5-19
070-007-843 ..... 5-5, 5-7
070-007-844 ..... 5-5, 5-7
070-008-126 ..... 5-5, 5-7
070-008-132 5-17
070-008-133 5-17
070-008-134 5-17
070-008-321 5-19
070-008-322 5-19
070-008-325 5-19
070-011-288 5-61
070-011-401 5-69
070-011-642-01 5-55
070-011-819 5-23
088-000-022 ..... 5-11, 5-15
088-000-038 5-15
088-000-039 5-15
088-000-040 5-15
088-000-093 5-23
088-000-107 ..... 5-11, 5-15
088-000-145 5-11
088-000-146 5-11
088-000-156 5-69
088-000-172 5-15
088-000-173 5-15
088-000-226 5-47
088-000-242 5-11
088-000-243 5-11
088-000-245 5-47
088-000-259 ..... 5-47, 5-49
088-000-422 5-13
088-000-500 5-11
088-000-502 5-13
088-000-503 5-13
088-000-504 5-13
088-001-034 5-55
088-001-089 5-25
088-001-154 5-69
088-001-211 5-51
088-001-264 5-47
088-001-293 5-17
088-001-353 5-23
088-001-522 5-53
088-001-528 5-63
088-001-534 5-63
088-001-535 5-63
088-001-539 5-63
088-001-558 5-69
088-001-571 5-55
088-001-572 5-55
088-001-591 5-57
088-001-594 5-57
088-001-601 5-47
088-001-603 5-47
088-001-604 5-47
088-001-605 5-47
088-001-607 5-47
088-001-610 5-47
088-001-631 5-17
088-001-634 5-47
088-001-640 5-55
088-001-641 5-55
088-001-804 5-65
088-001-822 5-63
088-001-823 5-63
088-001-824 5-63
088-001-825 5-63
088-001-858 5-55
088-001-859 5-55
088-001-861 5-55
088-001-862 5-55
088-001-879 5-69
088-002-274 5-69
088-002-275 ..... 5-55, 5-57
088-002-276 ..... 5-55, 5-57
088-004-601 5-63
088-004-602 5-63
088-004-604 5-11
088-004-606 5-63
088-004-607 5-63
088-004-609 5-11
088-004-650 5-63
088-004-716 5-63
088-005-500 ..... 5-21, 5-29
088-005-501 ..... 5-21, 5-29
088-005-502 ..... 5-27, 5-29, 5-37
088-005-503 5-31
088-005-513 5-37
088-005-532 5-35
088-005-540 5-27
088-200-477 5-11
088-200-481 5-69
088-200-695 5-69
088-201-182 5-69

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088-201-183 5-69
088-401-000 5-65
088-401-001 5-65
088-500-045 5-69
088-500-153 5-51
088-500-154 5-51
088-500-155 5-51
088-500-157 5-51
088-500-158 5-51
088-500-159 5-51
088-500-161 5-51
088-500-162 5-49
088-500-163 5-51
088-500-166 5-51
088-500-190 5-55
088-500-200 ..... 5-5, 5-7, 5-9, 5-15
088-500-222 5-9
088-500-225 5-11
088-500-226 5-11
088-500-238-01 5-11
088-500-239-01 5-11
088-501-669 5-69
088-501-708 5-69
088-501-721 5-69
088-501-738 5-69
088-501-739 5-69
088-501-744 5-69
088-501-745 5-69
088-501-751 5-69
088-501-764 ..... 5-63, 5-65
088-501-771 5-69
088-501-772 5-65
088-501-775 5-69
088-501-779 5-65
088-501-780 5-53
088-501-781 5-53
088-501-795 5-69
088-501-815 5-69
088-501-896 5-65
090-001-130 5-63
090-002-020 5-35
090-002-028 ..... 5-5, 5-7, 5-27
090-003-459 5-17
090-003-766 5-63
090-003-795 ..... 5-5, 5-7, 5-27
090-004-002 ..... 5-5, 5-9
090-004-003 ..... 5-7, 5-9
090-004-006 ..... 5-5, 5-7, 5-9
090-004-007 ..... 5-23, 5-27
090-004-010 5-23
090-004-017 5-17
090-004-028 5-69
090-004-033 5-45
090-004-113 ..... 5-39, 5-41
090-004-118 ..... 5-39, 5-41
090-004-119 ..... 5-39, 5-41
090-004-131 ..... 5-55, 5-57
090-004-136 5-55
090-004-203 5-59
090-004-302 5-69
090-004-520 5-63
090-005-015 ..... 5-23, 5-27
090-005-017 5-17
090-005-018 5-17
090-005-025 5-21
090-005-028 5-17
090-005-029 ..... 5-15, 5-17
090-005-034 ..... 5-5, 5-7, 5-9
090-005-254 5-23
090-005-256 5-53
090-005-257 5-23
090-005-264 5-21
090-005-265 5-21
090-005-270 5-59
090-005-271 5-59
090-005-272 5-59
090-005-273 5-59
090-005-274 5-59
090-005-279 5-61
090-005-503 5-37
090-005-504 5-37
090-005-505 5-29
090-005-509 5-27
090-005-514 5-27
090-005-520 5-31
090-005-521 5-31
090-005-522 ..... 5-39, 5-41
090-005-532 5-31
090-005-533 5-31
090-005-534 5-21
090-005-536 5-29
090-005-538 5-27
090-005-540 5-37
090-005-544 5-37
090-005-545 5-45
090-005-546 5-43
090-005-547 5-43
090-005-548 5-45
090-005-549 5-19
090-005-550 5-15
090-005-553 5-45
090-005-554 5-45
090-005-555 5-35
090-005-556 5-35
090-005-557 5-35
090-005-558 5-35
090-005-564 5-21
090-005-565 5-15
090-005-571 ..... 5-35, 5-39
090-005-576 5-21
090-005-577 5-45

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090-005-578 5-45
090-005-593 5-43
090-005-597 5-27
090-005-600 5-33
090-005-603 5-33
090-005-607 ..... 5-33, 5-35
090-005-612 ..... 5-33, 5-35
090-005-613 5-29
090-005-615 5-29
090-005-617 ..... 5-39, 5-41
090-005-629 5-31
090-005-631 5-31
090-005-637 5-29
090-005-640 ..... 5-39, 5-41
090-005-646 ..... 5-5, 5-7, 5-9, 5-27
090-005-647 ..... 5-5, 5-7, 5-9, 5-27
090-005-654 5-27
090-005-655 5-31
090-005-656 5-29
090-005-662 5-27
090-005-663 ..... 5-39, 5-41
090-005-723 5-17
090-005-876 5-11
090-006-125 5-23
090-006-126 5-23
090-006-127 5-23
090-006-128 5-23
090-006-129 5-25
090-006-130 5-25
090-006-131 5-23
090-006-132 5-23
090-006-133 5-23
090-006-134 5-23
090-006-135 5-23
090-006-136 5-23
090-006-137 5-23
090-006-138 5-23
090-006-139 5-23
090-006-140 5-23
090-006-145 5-23
090-006-230 5-69
090-006-243 5-69
090-007-310 5-63
190-001-490 ..... 5-19, 5-43, 5-45
250-001-046 ..... 5-5, 5-7
252-001-160 5-69
275-002-035 5-11
289-X09-216 5-11
289-X09-217 5-11
300-000-165 5-25
300-000-175 5-25
610-088-092 5-11
701-310-036 5-45
701-329-050 5-49
701-420-034 5-15
7023-410800-100 5-61
7050-034100-006 5-63
709-013-059 5-57
709-013-062 5-51
710-501-004 5-19
710-501-012 ..... 5-17, 5-21
711-512-040 5-47
711-516-020 5-47
711-520-012 ..... 5-13, 5-65
711-520-017 ..... 5-5, 5-7
722-505-002 5-55
724-511-074 5-11
730-027-019 ..... 5-35, 5-41
744-107-013 5-47
744-107-016 5-47
760-600-028 5-13
770-060-250 5-69
785-502-207 5-35
801-149-100 5-37
801-149-127 ..... 5-39, 5-41
801-149-247 5-37
801-369-161 5-27
801-757-121 5-63
801-765-241 5-63
801-865-287 5-61
801-865-367 5-61
804-557-731 ..... 5-5, 5-7
806-265-160 5-59
806-265-240 5-43
807-249-060 5-31
807-358-060 5-63
807-650-050 ..... 5-39, 5-41
808-549-120 5-29
808-549-160 5-47
808-549-200 ..... 5-29, 5-33
808-549-285 5-47
808-557-120 ..... 5-29, 5-55
808-557-140 ..... 5-25, 5-29
808-557-481 5-55
808-849-120 ..... 5-47, 5-55
808-849-160 5-55
808-857-120 5-55
808-865-160 5-55
809-149-100 ..... 5-37, 5-39, 5-41
809-849-100 5-47
809-849-125 5-5, 5-7, 5-11, 5-17, 5-47, 5-57, 5-65
809-849-165 ..... 5-29, 5-45, 5-59
809-849-205 5-59
809-849-285 ..... 5-5, 5-7, 5-49
809-849-325 ..... 5-5, 5-7
809-849-485 5-49
809-857-125 ..... 5-15, 5-53, 5-55, 5-57, 5-63, 5-65
809-857-165 ..... 5-53, 5-57, 5-59, 5-63
809-857-205 5-53
809-857-365 5-23
809-857-445 5-63

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809-865-104 ..... 5-5, 5-7, 5-9
809-865-125 ..... 5-21, 5-31
809-865-165 . 5-5, 5-7, 5-9, 5-15, 5-55, 5-57, 5-63
809-865-205 ..... 5-17, 5-23, 5-49
809-865-245 ..... 5-15, 5-17, 5-27, 5-45, 5-63
809-865-285 ..... 5-5, 5-7, 5-15
809-865-325 ..... 5-5, 5-7, 5-9, 5-31, 5-43, 5-63
809-865-365 5-45
809-865-445 5-23
809-865-645 ..... 5-55, 5-57
809-865-725 5-53
809-869-245 5-23
809-869-285 5-29
809-869-325 ..... 5-23, 5-27
809-869-365 ..... 5-21, 5-23, 5-27, 5-43
809-869-405 5-23
809-869-520 5-27
809-870-325 5-19
809-873-405 ..... 5-15, 5-19
810-249-240 5-45
810-250-200 5-61
810-265-280 5-15
810-556-320 ..... 5-5, 5-7
812-840-082 5-65
813-933-162 5-17
817-921-060 5-15
818-227-082 5-47
818-227-202 5-27
818-233-062 5-15
818-240-062 5-13
818-240-082 ..... 5-11, 5-15, 5-47
818-757-161 5-61
830-057-002 5-25
831-566-002 5-53
835-549-002 ..... 5-17, 5-27, 5-29, 5-33, 5-65
835-557-002 5-17
835-558-002 5-55
835-565-002 ..... 5-17, 5-49
835-570-002 ..... 5-17, 5-21
835-573-002 ..... 5-5, 5-7
835-670-002 5-21
838-369-002 ..... 5-23, 5-27
838-549-002 5-37
839-057-002 5-23
839-533-002 5-17
839-539-002 5-19
839-549-002 ..... 5-47, 5-49
839-665-002 .... 5-5, 5-7, 5-15, 5-17, 5-23, 5-27, 5-43, 5-45, 5-63
840-039-002 5-17
840-065-002 ..... 5-5, 5-7, 5-9, 5-17
840-066-002 5-31
840-070-002 5-19
840-182-002 5-19
843-121-002 5-15
843-127-002 ..... 5-13, 5-27, 5-47
843-133-002 ..... 5-15, 5-17
843-140-002 ..... 5-15, 5-31, 5-47
844-049-002 .... 5-5, 5-7, 5-11, 5-17, 5-29, 5-35, 5-39, 5-41, 5-45, 5-55, 5-57, 5-59, 5-65
844-057-002 .... 5-5, 5-7, 5-15, 5-23, 5-29, 5-45, 5-53, 5-55, 5-57, 5-59, 5-61, 5-63, 5-65
844-065-002 . 5-5, 5-7, 5-9, 5-15, 5-17, 5-21, 5-23, 5-27, 5-31, 5-43, 5-49, 5-55, 5-57
844-069-002 ..... 5-21, 5-29, 5-43
844-070-002 5-21
844-073-002 ..... 5-15, 5-19, 5-21, 5-23
844-074-002 ..... 5-55, 5-57
844-081-002 5-27
848-537-480 5-13
853-500-001 ..... 5-5, 5-7
855-349-010 5-37
861-013-062 5-51
861-206-042 5-51
863-030-080 5-47
872-062-012 5-51
879-849-487 5-27
880-139-120 5-19
880-139-200 5-17
900-104-071 5-19
900-110-141 5-21
900-110-161 5-43
900-112-203 ..... 5-55, 5-57
900-114-101 5-27
900-114-161 5-45
900-204-121 5-17
900-205-053 ..... 5-19, 5-45
900-205-081 ..... 5-33, 5-35
900-208-041 5-17
900-210-251 5-17
901-100-110 5-17
902-900-110 5-15
907-000-200 5-17
907-000-600 ..... 5-45, 5-49
907-000-900 5-15
907-200-500 5-63
907-201-000 5-63
907-202-600 5-63
911-073-307 5-61
912-137-200 5-19
913-411-100 5-59
913-415-100 5-17
913-415-120 5-19
913-423-120 ..... 5-19, 5-31
913-431-160 5-61
913-437-240 ..... 5-45, 5-61
913-464-400 5-21
913-464-480 ..... 5-17, 5-21
919-000-600 5-19
919-001-450 5-35
919-005-600 5-23

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919-005-800 .....5-55, 5-57
937-738-003 5-57
938-101-015 .....5-55, 5-57
938-637-100 5-25
945-091-242 5-61
945-867-242 .....5-5, 5-7, 5-27
947-271-967 5-27
948-637-072 .....5-17, 5-25
948-722-111.....5-25
948-753-102 5-5, 5-7, 5-11, 5-35, 5-47, 5-59, 5-65
948-761-112....5-5, 5-7, 5-25, 5-45, 5-53, 5-55, 5-59, 5-65
948-767-132..5-5, 5-7, 5-9, 5-23, 5-31, 5-55, 5-57
948-868-162.....5-23
948-975-172.....5-39, 5-41, 5-55, 5-57, 5-61
948-983-212..... 5-27, 5-31
949-071-227 5-19
949-100-002 5-27
951-148-002 5-61
951-156-002 5-25
951-164-002 .....5-15, 5-21, 5-31, 5-55, 5-57, 5-63
963-200-002 5-17
963-300-002 5-19
963-400-002 5-5, 5-7, 5-27, 5-33, 5-35, 5-37, 5-39

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